LIBRARY OF CONGRESS
JAN 24 1899
#03661
SMITHSONIAN DEPOSIT.


# THE AMERICAN GAS LIGHT JOURNAL

REDMANAKENNY.N.Y.

PUBLISHING OFFICE No. 32 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXX. No. 4 Whole No. 1,233. | NEW YORK, MONDAY, JANUARY 23, 1899. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager. THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

**Published** on each Monday of the year, at No. 32 Pine Street, New York.

**Collections** are invariably made directly from this office for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

**Terms of Subscription, Including Postage.**—For the United States and Canada, $3 per annum. European countries, $4.50 (19 shillings—22½ francs). All payments to be made in advance. Single copies, 10 cents.

**Correspondence.**—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

**Remittances** should be made either by post office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

**The American News Company,** Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

*The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.*


## CONTENTS.

An Asterisk (*) denotes an illustrated article.


OFFICIAL NOTICES—
- Twenty-eighth Annual Meeting of the New England Association of Gas Engineers..... 109
- Sixth Annual Meeting, Michigan Gas Association..... 109
- Change of Meeting Time, Western Gas Association..... 109
- Wrinkle Department, Western Gas Association ..... 109

EDITORIALS—
- Briefly Told ..... 110
  Notes.
- The Growth of our Oil Trade, by Mr. W. G. Irwin..... 110
- The Education of Electrical Apprentices and Journeymen, by Mr. A. A. Hamerschlag ..... 111
- Notes on the Distribution of Alternating Currents, by Mr. S. E. T. Ewing—Continued from page 80..... 113
- *Egner's Improved Apparatus for Manufacturing Gas ..... 114
- *The Lewis Gas Engine..... 115
- *The Culnane Hydraulic Pile Sinking Machine..... 116
- The Recovery of Bye-Products..... 117
- The Penetration of Beams of Light, by Mr. B. Speed..... 117
- A Symposium on Pipe Lines..... 118

ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 119
Mr. Boileau Retires—Annual Meeting, New Orleans, La.—Contract for the Riter-Conley Company—Acetylene Does Not Go—Annual Meeting, Dover, N. H.—Proposed Gas Works for Ocean City, N. J.—Change in Ownership, Kearney (Neb.) Plant—Annual Meeting, Williamsport, Pa.—Improving the Royer's Ford (Pa.) Plant—A Hint from Englewood, N. J.—Annual Meeting, New Albany, Ind.—Death of Mr. W. W. Rand—Artificial Gas Plant for Bellevue, O.—In the Matter of Gas Rates, Louisville, Ky.—More Gas Rate Tinkering, New York City—Annual Meeting, Newport, R. I.—And Many Other Items.

- Washington Coal Mines in 1898..... 121
- The Market for Gas Securities..... 121


[OFFICIAL NOTICE.]

### Twenty-eighth Annual Meeting of the New England Association of Gas Engineers.

OFFICE OF THE SECRETARY, LYNN, MASS., Jan. 16, 1899.

To the Members of the New England Association of Gas Engineers:

The twenty-eighth annual meeting of the New England Association of Gas Engineers will be held at Young's Hotel, Boston, on *Thursday* and *Friday*, February 16th and 17th, 1899.

The matters for discussion will be announced later. Members are requested to send to the Secretary questions for the Question Box, and are especially urged to contribute to the meeting short papers on any subject pertaining to the business.

The Secretary will send blank applications for membership to those desiring them.

Carefully note the change of date from the usual Wednesday and Thursday to Thursday and Friday.

CHARLES F. PRICHARD, Secretary.

[OFFICIAL NOTICE.]

### Sixth Annual Meeting, Michigan Gas Association.

OFFICE OF THE SECRETARY, SAGINAW, MICH., Jan. 11, 1899.

To the Members of the Michigan Gas Association: Gentlemen—The Sixth Annual Meeting of the Michigan Gas Association will be held in Lansing, on Wednesday, the 22d, and Thursday, the 23d, of February, next. Location of headquarters and list of papers to be presented will appear in due time. Respectfully, HENRY H. HYDE, Secy.

[OFFICIAL NOTICE.]

### Change of Meeting Time, Western Gas Association.

WESTERN GAS ASSOCIATION, OFFICE OF THE SECRETARY, NEW ALBANY, IND., Jan. 10, 1899.

To the Members of the Western Gas Association:

On account of the inclement and disagreeable weather usually prevailing in Milwaukee during the month of May, the Board of Directors, acting upon the advice of the Entertainment and Executive Committees, have unanimously voted (with the exception of Mr. Littleton, who is in Europe), to change the date of the next annual meeting of the Western Gas Association, from May 17, 18 and 19, to June 14, 15 and 16.

Members of our Association, and all who may desire to attend our next annual meeting, will govern themselves accordingly.

JAMES W. DUNBAR, Secretary.

[OFFICIAL NOTICE.]

### Wrinkle Department, Western Gas Association.

WESTERN GAS ASSOCIATION, OFFICE OF THE SECRETARY, NEW ALBANY, IND., Jan. 16, 1899.

To the Members of the Western Gas Association:

Mr. E. H. Jenkins, Editor of the Wrinkle Department, desires it known that those who have contributions to offer for publication in

this valuable division of the Association's proceedings, should forward the same at as early a date as possible. All matter of this nature should be in hand not later than April 1st. Let no member fail to mail Mr. Jenkins a description of any device that saves labor or insures through its use better service in the production or distribution of gas.

Address all communications to Mr. E. H. Jenkins, Engineer Buffalo City Gas Company, Buffalo, N. Y. J. W. DUNBAR, Secretary.

## BRIEFLY TOLD.

NOTES.—We regret to have to report the death of Mr. William Eliot Fette, who succumbed to the effects of an operation for relief from appendicitis, the morning of the 11th inst. Deceased, who was in his 59th year, was at one time prominently identified with the Boston and South Boston Gas Companies. He also had large interests in the Dedham and Hyde Park, the Danvers and the Marblehead Companies.——On the 16th inst. the United States Supreme Court issued a writ of error to the Court of Appeals, of the District of Columbia, under which the latter is instructed to reverse the decision of the Supreme Court of the District of Columbia, and conduct a new trial on the merits of the original case. This action hinges on the suit brought by Mr. Thomas G. Lansden against the Washington Gas Light Company for libellous damages. The jury, if our memory is right, in the original instance mulcted the Washington Company in the sum of $12,500, which award and action, on appeal, were sustained by the Court of Appeals of the District. The sense of the writ issued by the U. S. Supreme Court is that the case will have to be tried anew.——A correspondent in Stockton, Cal., writing under date of the 13th inst., says: "The Sacramento (Cal.) Natural Gas Company has had a prosperous year, and the management thereof proposes to increase its main mileage—during the past twelvemonth the Company completed the laying of six miles of distributing mains. The officers elected at the annual meeting of the shareholders were: Directors, Jerome Haas, John McCormick, Henry Ells, J. L. Jensen and H. C. Keyes; President, Jerome Haas; Vice-President, John McCormick; Secretary and Treasurer, Henry C. Keyes."——The Directors of the Danville (Ky.) Gas Company have notified the residents of Danville that, until further orders, the selling rate shall be $2 per 1,000 cubic feet gross, with 10 per cent. off for prompt payment—within 10 days.——A correspondent in Kansas City, Mo., writes: "Councilman Mockett, of the Lincoln (Neb.) city government, is responsible for the introduction of an ordinance proposing the regulation of gas rates in that city under these terms: 'Hereafter it shall be unlawful for the Lincoln Gas Company, or any individual copartnership or corporation engaged in the manufacture or sale of illuminating or fuel gas within the city, to charge for such gas furnished to citizens or consumers a price exceeding $1.35 per 1,000 cubic feet; and no rent shall be charged for gas meters when 300 cubic feet or more per month have been consumed; but if any amount less than that is consumed in a month a meter rent not to exceed 25 cents per month may be charged.'"——The new generating plant of the Johnstown and Gloversville (N. Y.) Gas Company is in successful operation. The plant is located in Gloversville.——The "Hall process" system, with the "Doctor" J. W. Chisholm faction at its helm, has determined, before the San Francisco bubble of its creation has been punctured, to have a try at the Oakland (Cal.) gas field. The irrigating concern has been baptized under the title of the Equitable Gas Light Company of Oakland, and is sluiced in its capital to the quantity of 1,500,000 dollars or gallons. The official irrigators are: Directors, W. J. Dingee, Charles L. Ackerman, William J. Henshaw, J. W. Chisholm and William J. Landers—the latter is President of the San Leandro Gas Company; President, W. J. Dingee; Vice-President, Chas. L. Ackerman; Treasurer, William J. Henshaw. The main offices (or reservoirs) of the concern are to be for the present in the Mills building, San Francisco. The proposition is to supply gas in Oakland, Alameda and Berkeley, on illuminating account, at $1 per 1,000; on fuel account, 75 cents per 1,000—neither of which rates will yield a profit to those financially concerned or interested.——The Boston (Mass.) *Evening Herald*, dated the 17th inst., tells this plain tale: "The public subscription to the $8,640,000 bonds of the New England Gas and Coke Company, at par, is declared to have been $1,800,000. The underwriters took the balance at 97."——At the annual meeting of the Oneonta (N. Y.) Gas Company the following Directors were elected: F. D. Miller, M. L. Keyes, M. L. Ford and G. A. Lane.——Under the sensible management of the Messrs. Cox (father and son) the business of the Mount Holly (N. J.) Company steadily increases,

## The Growth of our Oil Trade.

By MR. WILLIAM GILBERT IRWIN, in *Sci. Am.*

In the oil regions there always has existed and always will exist a speculative fever. The risks, the possibilities, the ebb and flow of fortunes, the periodic frenzies and the fluctuating prices of the product all add to the romance and interest of the oil fields, and help them to create their own atmosphere.

The story of the rise of this great industry has an absorbing interest. During the last half century hundreds of millions of dollars have been expended in opening this vast dormant source of wealth.

The latest available statistics (for 1896) place our annual production of petroleum at 60,960,361 barrels. The foreign product for the same year was 47,552,886 barrels, which makes a grand total production of 108,512,947 barrels. The value of this product is upward of $100,000,000, and after having passed through the refining processes and the complex processes of modern chemistry, this crude oil represents a myriad of diversified finished products of industry and its total value is enormous.

Like other similar branches of trade, all this vastness has sprung from the work of some farseeing genius and the work of some few pioneers who lived in the van of their time. Northwestern Pennsylvania can well claim the honor for the inauguration of the oil trade, and 1849 was the year of its birth. The existence of oil in Northwestern Pennsylvania and Western New York was known to the Indians from the earliest days. When first the French came to this region they were shown the oil springs, and the earliest English settlers were aware of the presence of those on Oil Creek. In the year 1819 the presence of petroleum was noticed in salt wells sunk along the Ohio. In the early days of the century a few gallons were occasionally gathered from the surface of springs and taken to Pittsburg by the lumbermen with their rafts, and the product became widely known under such names as "Seneca oil," British oil," "Genesee oil," etc. In the early forties Samuel Kier began the preparation and sale of the oil, and, bottled and prepared for medical purposes, it attained a wide sale. His supply was obtained from an old salt well at Salina, on the Kiskiminetas.

But as yet the product had no real commercial value. The crude oil was not fit for lighting purposes on account of its dark smoke, and its use for heating purposes was also impossible. As a lubricant it was used only in a small way. The first lease of oil lands, with a view to putting down an oil well, ever made in this country, was that of a tract containing an old oil spring, located in Cherrytree Township, Venango County, Pa., and it was made by J. D. Angier to Brewer, Watson & Company, in the year 1853. The lease was for five years.

But this venture was not destined to have an immediate success. In 1854 Dr. F. B. Brewer, a son of the senior member of this pioneer oil firm, went to Hanover, Mass., taking with him a bottle of the oil for medicinal purposes. There Dr. Brewer presented the oil to his relative, Prof. Crosby, of Dartmouth College, and shortly afterward it came to the notice of George H. Bissell, a New York lawyer. A visit to the spring was the result, and Bissell and his partner, Jonathan G. Eveleth, purchased from Watson, Brewer & Company 105 acres of the land they had leased. In the same year (1854) the Pennsylvania Rock Oil Company was incorporated under the laws of the State of New York, but, owing to legal complications and the prostration of the money markets, which had taken up the stock, the project was delayed for several years.

Up to this time the idea of boring for oil had not been thought of; but in 1856, when Bissell went to see Kier, and learned that his preparation was obtained from a salt well 400 feet deep, the idea at once came to his mind, and in 1858 Edward Drake, a stockholder in the Pennsylvania Rock Oil Company, was engaged to drill a well. In the meanwhile the Pennsylvania Rock Oil Company was succeeded by the Seneca Oil Company, of which concern Drake became president.

Saturday, August 28, 1859, is a day justly celebrated in oil country history, for on that day oil was struck in the Drake well at a depth of 70 feet. Two days later the well was producing 20 barrels per day. This was the beginning of the oil excitement, the history of which has scarce a parallel. The story that oil was being pumped from the earth as freely as water was at first scouted, then accepted as a curious phenomenon, and finally it came to be believed as a fact.

When it became known a little later that oil gushed from the earth of its own power by the hundreds of barrels, the excitement became a wild mania. The desire to speculate in oil and oil lands became general. The sober farmer who received fabulous prices for his poor farm joined in the frenzy. Fortunes of gigantic proportions were won and lost in a short space of time.

Titusville grew in a few weeks from a town of 100 people to a city of

15,000. The region of the oil excitement extended rapidly, until nearly the entire Northwestern Pennsylvania was one vast oil field. Everywhere towns and cities sprang up as if by magic. While hundreds of these were mushroomlike and have long ago been effaced from the earth, others were stable and remain to this day as memorials to the rise of this great industry. In time great oil fields were opened up close to Pittsburg. Then the Washington and Greene county fields in Southwestern Pennsylvania were brought in, and later the West Virginia fields were opened up. The Lima field of Ohio and the fields of Indiana in their turn were opened up, and other States joined in the procession.

For over a quarter of a century from the time of its opening the New York and Pennsylvania region of the Appalachian field stood alone in the production of petroleum, and there was not a producing oil well outside the Appalachian field until the opening of the Lima field, begun in the year 1885. In 1859 about 2,000 barrels of oil were produced about Titusville, Pa. The production of that region in the year 1860 was 500,000 barrels, and 10 years later Pennsylvania was producing upward of 5,000,000 barrels annually. The production of the New York and Pennsylvania region in the year 1880 was 26,027,631 barrels, and in 1882, when this region produced 30,053,500 barrels, the climax was reached. The production of this region in 1890 was 28,458,208 barrels, and in 1896, 20,484,421 barrels were produced. Titusville, Oil City, Franklin, Pithole and other towns have successively been the center of this oil country, and ever since the first well was put down there has been a constant shifting of the center of the industry. Within the last decade the oil territory developed about Pittsburg and in Southwestern Pennsylvania has virtually made Pittsburg the center of the oil business, and the development of the West Virginia region has assisted Pittsburg in retaining her mastery.

While oil in considerable quantities was produced in West Virginia as early as 1875, it was not until the year 1885 that the oil business in that mountain State was really begun in earnest. West Virginia's production in that year was 91,000 barrels. In 1890 that State produced 492,578 barrels, and the next year the Sisterville region was brought in, and the production of that State was increased to 2,406,218 barrels, and the production for 1896 was 10,019,770 barrels. The Southern Ohio region, included in the Appalachian field, was an early oil-producing section. In 1880 it produced 38,490 barrels, and in 1885, when the Lima field was developed, Ohio produced 661,580 barrels. In 1890 Ohio produced 16,124,656 barrels and in 1896 she led all other States, having a production in that year of 23,941,169 barrels. California produced oil as early as 1875. The California field is located in the southern part of that State. Its production in 1880 was 40,552 barrels. In 1890 California produced 307,360 barrels, and in 1896 its production was 1,252,777 barrels. The first recorded production of the Colorado field was in 1897, when the production was 76,295 barrels. In 1890 that mountain State produced 368,842 barrels. Its production in 1892 was 824,000 barrels, and in 1896 this had dwindled to 361,450 barrels. The production of Kentucky and Tennessee never was large, and very little oil is now produced in these States. The Indiana part of the Lima field was developed in 1889, and that year Indiana produced 33,375 barrels. New regions were developed in 1893, and Indiana's production in that year was 2,335,293 barrels, and in 1896 it produced 4,680,732 barrels.

Thus have we given in detail the opening and production of the oil fields of our country and the production of the different States at different periods in the growth and development of the industry. It will be seen that the Lima and Indiana fields now lead all others, having in 1896 produced 33,970,222 barrels, against the 25,255,870 barrels produced in the Appalachian field. It is only when we pause to consider the magnitude of the work required to extract from the bowels of the earth the great latent store of Nature's contribution to modern industry that the magnitude of the oil trade becomes fully settled in the mind. There are to day not less than 20,000 producing wells in this country, and every year thousands are being added to these. The "dry holes," it must be remembered, far outnumber the producing wells, and in these millions of dollars are lost every year.

America led in the opening of her oil fields. Since the development of the industry in this country oil producing fields have been developed in foreign countries. More than 2,000 years ago petroleum in its crude state was known to the Greeks and Romans, and for centuries the springs and wells of the Rangoon district, on the Irrawaddy, have supplied the entire population of British India. Baku, now the center of the great Russian oil fields, has supplied Persia with artificial light, and for more than two centuries Parma and Modena have furnished Italy with petroleum. The product is found in Trinidad and Cuba, it is to be seen floating upon the surface of the water in the vicinity of volcanoes, and old Vesuvius has her oil springs; but no attempt at the utilization of this fuel product was made in the old world until after it had undergone its early stages in our own country, and even to this day we lead all the world in the production of petroleum. Against our production of 60,960,361 barrels for the year 1896 the entire foreign product was but 47,552,866. Russia leads the foreign countries with 39,882,122 barrels, and the production of the other countries for the year 1896 was as follows: Austria Hungary, 2,443,080; Great Britain, 1,500,000; Canada, 801,725; Japan, 1,324,850; Java, 505,029; Germany, 145,061; India, 371,830; Italy, 20,841; Peru, 15,000; Sumatra, 4,380,000.

The large production of mineral oils in other parts of the world, while it has not reduced our exportation, has probably reduced the prices which our producers and exporters have been able to realize. The exports of oil in the year 1898 were practically double those of 1888 and three times those of 1878, but the money received for them was only about 25 per cent. greater than that received either in 1878 or 1888. The total receipts for the 1,034,269,676 gallons of oil exported in 1898 were $56,126,578, while for the 578,351,638 gallons exported in 1888 the receipts were $47,042,409, and for the 338,841,303 gallons exported in 1878 the receipts were $46,574,974. The average export value of refined illuminating oil was, in 1872, 24.9 cents per gallon; in 1878, 14.4 cents per gallon; in 1888, 7.9 cents per gallon; and in 1898, 5.2 cents per gallon; having thus fallen from 24.9 cents to 5.2 cents from 1872 to 1898. Notwithstanding this steady fall, the production and exportation continue to increase, the exports having increased over 60,000,000 gallons in the past year over that of the preceding year, and over 100,000,000 gallons over that of any earlier year, while the production for 1897 was 2,528,067,984 gallons, against 2,033,331,972 in 1894; 1,476,867,546 in 1890; 1,017,174,396 in 1885; 836,394,132 in 1880; and 510,825,588 in 1876. Thus, while the price has been steadily and rapidly falling, the quantity produced and the quantity exported have as steadily and rapidly increased. The production in 1897 was five times that of 1876, and the exportation of last year nearly five times that of 1876. Great as the fall in price has been, the exports of illuminating oil bring over a million dollars a week into the country, and have in the past 20 years added a round billion of dollars to our foreign sales.

Our oil products reach every continent and all the principal islands of the earth. They go to every European country, to China, Japan, Australia, Egypt, Transvaal and Brazil. With every year our trade in oil, both foreign and domestic, is increasing, and, unlike the gas fields, our oil fields are so far from exhaustion that that event has not yet been given a serious consideration.

## The Education of Electrical Apprentices and Journeymen.

By Mr. Arthur A. Hamerschlag.

The old world has given us excellent mechanics through its apprenticeship system. Unfortunately even in those countries that system is dying out. This country has never had a well developed apprenticeship system, and to-day it has almost entirely disappeared because of the peculiar restrictions placed thereon by the unions and associations and the centralizations of the work under single financial heads, paying men by the hour or day, and whose employees shift from place to place as the demand for their services varies from busy to dull times. In fact, to-day the apprenticeship system is almost impossible for financial and other reasons, so we must devise some other means of educating the youth who wishes to enter the electrical field.

It is true that three or four of the largest electrical concerns do apprentice young men, but the number is comparatively small, and it requires considerable influence to secure such indentures. The number of applicants is, however, out of all proportion to the number that can be accommodated, and such openings are almost entirely out of the reach of the vast majority because of isolated locations.

Electrical work as a trade and as a profession is now undergoing the same trials and tribulations regarding the educational means that other trades and professions have undergone in the past, except that the problem in the electrical industry, owing to its rapid growth, is of vastly greater urgency. Because of this growth along scientific and mechanical lines, improvements succeed improvements so rapidly that what was considered good practice yesterday becomes obsolete and defective to-morrow. The men, or mechanics, who but a few years ago handled cleats and moldings in wiring, are to-day asked to use iron pipe and conduit, requiring totally different tools, materials and methods. And where do these men acquire the efficiency and facility for this work? They acquire it in the crudest and most uneconomical method

possible, by experimentally using their employer's material and at his expense in the time during which he is compelled to pay for skilled labor. These improvements certainly result in the loss of journeymen's efficiency, and in "rule of thumb" mechanics.

This type of mechanic is to be found in all trades, and sometimes he is exceptionally skilled in his work, and thus causes a tendency on the part of employers to desire more men like him, especially when he is placed side by side with the so-called theoretical mechanic who lacks the skill.

The fallacy of this reasoning is at once apparent when the "rule of thumb" mechanic comes in competition with the well grounded and educated mechanic who possesses an equal amount of skill. Then the efficiency of the latter is so much greater that there can be no comparison. Oftentimes we meet men with such a vast preponderance of theoretical training that it has removed the inherent practical skill, and this type of journeyman is almost useless when judged from the working standpoint. This latter condition is not a rare one by any means, and just a few words concerning it may be appropriate.

A glance over the list of our numerous educational institutions causes us to feel proud of our achievements in this line. In almost every settlement or city throughout the country some school, college or university is supported upon as lavish a scale as one could desire. Endless seem the opportunities which the young American has to acquire the learning and higher education which are prized and cherished in the world to day. We have schools for every conceivable purpose. We have colleges and universities for every profession, and we have technical institutions almost unmatched in efficiency. But we have only a very few practical trade schools, and for the education of electrical mechanics fewer still. And yet, in which field can we utilize, at present and in the future, the greatest number of skilled men in the engineering branch or in the skilled labor branch? The answer must obviously be in the latter. Still parents will persist in sending their children, regardless of their inherent qualities, to the colleges and universities to master a profession without giving a thought to the field in which their future labors must be conducted, without considering the compensation they will receive. And what is the result? There can be only one general reply.

After years of study and much money spent in acquiring the profession and an early association with children of wealth and refinement, the born mechanic becomes ruined for the sake of experimenting for a genius, or a great engineer. The field for mediocre engineers is just as narrow and confined as it is for the mediocre artist, the compensation for his labor is equally curtailed, and as a result when the young man is thrown on his own resources he must suffer that genteel poverty which his training in refined circles has bound him to. He can no longer look with pride at the work of his hands, and his brain power being but of the average, he suffers acutely and eventually becomes neither an excellent mechanic nor an excellent engineer.

Each year the colleges and universities are sending into the world large numbers of young men who, after years of work, take the title of "electrical engineer." How many of these will ever have an opportunity to do any genuine electrical engineering? How many of them are destined never to earn, in the electrical line, $1,000 or so a year, the pay of a skilled mechanic?

For every single opening for an electrical engineer there are a hundred openings for the skilled journeyman, and for every successful engineer there are a hundred successful journeymen. And to be a journeyman does not mean to be debarred from engineering.

Who have made the notable inventions? Who have carried out the greatest engineering problems? Not the trained engineer, but the journeymen who have started at the bottom, and by their individual efforts raised themselves to the highest level. "By their deeds ye shall judge them" is true of men, whether they have been educated up to a high standard or not, and self-training is often the more effective.

The compensation for skilled electrical labor such as journeymen bring into the market, has been on the increase; it will continue to increase, and in an unfair degree, unless those who are the employers think in time of a method of supplying the increasing demand, or of making the labor which is offered worth the increase in results achieved.

Every new electrical equipment, each railroad equipped electrically, and each industry which depends on electricity is taking some of our skilled men from the open market and retaining them permanently and confining their energy to maintaining such equipment.

Whence will come the men to replace these defections? Has no one a solution to offer as to the best way of replenishing the supply?

Many methods of solving this problem have been tried, some of them without proper consideration of the case. Some have been the education of journeymen in other trades, such as carpenters, draughtsmen, etc., by means of actual experience during their employers' time—a poor means at best, and which places the burden directly on the shoulders of the employers, while the resulting mechanic leaves much to be desired in all round efficiency.

Oftentimes young men, imbued with the desire to be electrical artisans, attend in a desultory fashion popular lecture courses, witness a few experiments in static and galvanic electrity, and find them of such interest that, even though they possess little or no qualifications, and have been educated and trained for other lines, they determine to make electricity their life work. Their method of securing the necessary instruction is usually a so called apprenticeship in a shop manufacturing some article, which in itself gives them comparatively little instruction, and which makes them eventually skilled in head work, without giving them any breadth of training, and merely enables them to fill the position of a slim, automatic machine.

Sometimes they read electrical lectures and trade papers, in many instances finding themselves very much at sea, because of the technical character of the papers and articles which their previous training has done nothing to enable them to understand. Sometimes as a final resort they become recipients of the training offered by correspondence schools, and these schools are certainiy gathering an ever-increasing clientele, which their merit justifies.

In very rare instances they attend by far the best and most modern form of securing this training, and that through the trade school. There are, however, so very few of the latter institutions in spite of their acknowledged merit, and they are so little known, that only a very small percentage of the number who wish to become electrical craftsmen can reap their benefits.

The superiority of the trade school for educating and equipping young men for trade work is so vastly superior to any other form of acquiring the result that to it in the future must we look to solve this very serious problem. Foreign countries have realized this fact for many years and profited by it. Is it not time that this progressive country began to realize it also, and to stimulate and support such institutions? They certainly are bound to spring into existence, and those that exist and have an honorable record are bound to improve that record, and it is but a question of time when intelligent thinkers must give them their proper place and dues.

It has been my good fortune to have been connected with trade schools for some years, notably with the New York Trade School, St. George's Evening Trade School, of New York, and the Highland Falls Trade School, of Highland Falls, N.Y. They have taught me a lesson which I hope to profit by in the future, not alone concerning the electrical industry, but concerning many trades. It is a lesson, however, which applies in an equal measure to them all. And it is that trade schools have as equally high aim and purpose as that of any educational institution in the country. That the field which they cover cannot be covered in any other way, and if they were accorded the same support and encouragement by the fraternity and public that other educational institutions receive, their effect and beneficent influence would be as widespread, if not felt in even a greater degree, because of the class which they aim to assist.

It seems strange to me that trade schools should be subject to such marked indifference by the employers and to such intense persecution and criticism by the fraternity which they aim to assist, merely because of the possible future competition their graduates will cause when they have come to the journeymen's estate. Was there ever a scientific institution aiming at higher education, a medical college, a law or an art school, but received the support and indorsement of the leaders of the respective professions if its object was not to make money but to benefit the respective branches?

Are the prominent lawyers, physicians, artists or the men of any other profession less free from the thought of future competition than the journeymen and the employer that the latter should be found wanting in that which tends to advance his profession?

The governing societies, the trade associations, the employers' associations must see the wisdom of the trade schools eventually, and when they will realize the necessity for them, and be compelled to support them, then, indeed, will they see the error of their ways.

A society like the American Institute of Electrical Engineers, whose members comprise a very large number of the engineers engaged in electrical enterprises, can do much to bring this problem before the men of their line, and can materially assist in a solution of this problem of so much importance to the welfare of the electrical industry. The youths of the country, imbued with the desire to become electri-

cians, will force their way in, and the inevitable is bound to occur. These young men will eventually enter the field of their choice. Why not help them and encourage them to enter under the best conditions and highest possible standard, instead of leaving them to drift in, unequipped, inefficient and lacking in essential requirements. Is it not best for them to live up to the studies exacted of skilled artisans in other lines, so that they cannot only become self-reliant and successful but reflect credit on the fraternity to which they have given their allegiance.

Trade schools have in the past done much to assist young men to acquire the rudiments of trades in other lines. They have tended to raise the standard of the individuals styling themselves helpers and journeymen by determining the capacity of the beginner, and they have put the highest premium on skill and efficiency.

What I wish to impress most seriously on my hearers is that this question of educating apprentices and journeymen bears a vital and urgent relation to the future success or failure of an industry in which we all feel commendable pride.

The New York Trade School, owing to the far-sightedness and philanthropy of its founder, Col. Tylden Auchmuty, has been in the field to remedy this coming dearth of skilled mechanics and the crowding out of our home industries of the native born American workers by foreign skilled labor. Aided by the munificence of Mr. J. Pierpont Morgan and other gentlemen, it has been able to broaden its scope, until to-day it ranks as the pioneer and largest trade school in the country. With its 6,000 graduates it has demonstrated its utility and shown the way to those who wish to follow.

Three years ago it took cognizance of the electrical situation and immediately inaugurated a thoroughly practical course for electrical workers, which became at once an assured success, filling the class room to its fullest capacity and having a waiting list of young men eager to enter the classes.

The first year the class numbered 32. The second year a larger department was inaugurated, and 50 were accommodated, and still the waiting list continued to be as large. This year 50 are again at work and fully that number were turned away. The course is thoroughly practical, because nothing is taught which is not done by the students themselves and tested and proved before acceptance. I have appended a list of the various operations taught, which will show how broad and effective the course is. This year a course for journeymen workers in the form of practical lessons will be inaugurated. Its success is problematical, but should it show any signs of growth and interest it may lead to future results which cannot fail to be of interest to the whole electrical fraternity.

(The lecture was accompanied by numerous lantern slides illustrative of the school.)

[Continued from page 80.]

## Notes on the Distribution of Alternating Currents.

By Mr. S. E. T. Ewing, in *Elec. Engr.*

*The Installation of Transformers, Pits and Sub-Stations.*—The high tension main ends either at a sub-station or transformer pit, or on a consumer's premises. As the latter is the simplest case we may consider it first. The Board of Trade regulations provide that when a high tension transformer is installed on private premises it must either be placed in a brick chamber provided with an iron door, or that it and all the high tension apparatus be completely inclosed in an iron case, which case is to be permanently and efficiently connected to earth. In a majority of cases in house transformer work the brick chamber is the better plan, particularly if the transformers in use are not supplied in iron cases. The great advantage of this method is that the high tension mains can be brought in and taken out again through a pair of fuses or connectors, giving a ready means of breaking up the circuit for testing. It is generally advisable, when a fair-sized chamber close to the roadway can be arranged for, to lay two or three pipes into it from the street, whereby it may sooner or later supply other neighboring consumers through a low tension main. Many makers now supply small and moderate power transformers fitted with an earth shield, and with high and low tension fuses complete in a cast iron case, and these require little more than the simple connection of the cables through the watertight glands and a good earth connection. Where, however, unprotected transformers have to be installed hurriedly, a galvanized iron tank of ordinary stock pattern, with a few holes tapped for a cover to be screwed on, makes a convenient substitute for a cast iron case. In all cases the iron pipe containing the high tension mains must come right up to the transformer case, be metallically connected throughout and be properly earthed. A stout water main forms the best earth. Gas pipes, particularly composite, should never be used. The pipe containing the mains should not be used as an earth unless it is of considerable length, or unless it is metallically connected to the other iron pipes of the system in the service box. When a number of house transformers are in use the earth shield to each transformer costs less than the Cardew earthing device. For banked transformers in sub-stations the Cardew device is the better, as one serves for several transformers and allows of inspection wherever necessary. When a sub-station is being built, it is a good plan to bury a large earthplate in the surrounding soil, together with a load of moist coke, and bring a stout connection therefrom into the chamber. This brings us to the subject of sub-stations.

Space forbids any attempt to describe the complete equipment of even a few representative of actual practice, but the main features of design that are advisable may be mentioned. In the first place, there is the choice between sub-stations proper and transformer pits. The sub-station either under or above ground is on many accounts greatly to be preferred, but in many cases the cost, which may amount to anything up to $300 or $350 for a moderate sized chamber, exclusive of equipment, renders it out of the question when the lamp density is small. It is, we believe, somewhat generally considered among station engineers that the largest size transformer which it is advisable to use in average town distribution is about 30 kw. No important saving in magnetizing losses accrues from using a larger size, and considerations of weight and size, and consequent ease of handling in crowded streets, render this about the limit of size which can readily be got in and out of underground pits and chambers. Consequently it may be said that whenever the probable future demand renders it unlikely that more than 30 kw. can be economically distributed from one transforming point, a transformer pit of ample size should be put down; whenever this demand is likely to be exceeded a sub-station is advisable. Of course in a few cases suitable room can be found on corporation property, or something of that kind, which saves a great portion of the expense, but companies have usually nothing to choose save between underground work or the rental of a cellar or portion of a back garden or yard, if such can be obtained at reasonable rental in close proximity to the street.

Assuming, then, that it is decided to put down a transformer pit, the question of its design offers many points on which great differences of opinion exist. It can without difficulty be made practically watertight, and an unprotected transformer can then be used, but this means that it is also more or less airtight, and with a fairly large transformer a dangerously high temperature will be attained. The better plan is to use a transformer provided with a watertight case, and allow the pit to ventilate freely into the neighboring switch or connection box. A few inches of water in the bottom will do no damage and can be easily removed with a hand pump. In either case the switch and fuse gear should be contained in a separate box alongside the transformer pit, or if it can be conveniently arranged for, in an iron box sunk into a recess in an adjoining wall. If the transformer feeds in parallel with others on to the distribution mains, both high and low tension switches and fuses will be necessary to enable it to be isolated. These switches are preferably worked by a common controlling handle. In closing, however, the low tension switch should make contact an instant before the high tension, allowing the iron to be magnetized by the current from the secondary mains before the primary current enters. This prevents the current rushes in the primary, which may take place if the iron be oppositely magnetized at the instant the current is put on, though this is not a common trouble save in the case of large transformers.

In the case of a transformer which is not in parallel with others on the secondary side, the low tension switch may be dispensed with. These combined high and low tension switches and fuses are supplied by several makers, fitted with cast iron cases and watertight glands for the cables, and actuated by an outside handle. They are, however, complicated and expensive, and a further objection is that there is no guarantee that the current is really off the transformer upon which the work has to be done, save the audible snap of the spring switch gear inside the case, and the position of the controlling handle. It is greatly preferable to be able to see the switch open, or the fuses taken out by hand, as is possible when a wall box is used or in a sub station, but in cases where the work must be put into a street box their use is indispensable. One leading firm who have had great experience in alternating current distribution have lately designed and put on the market a most excellent cast iron transformer box, in which all the switch and fuse gear is contained in the space above the transformer, is well pro-

tected and worked by a handle outside the box. Provision is made for a maximum demand meter, which should be of the greatest value, and before working on the box, the inner of the high tension main and the earthed outer can be plugged together. Of course, this box is made for the standard type of transformer made by the firm.

If a sub station be built underground, the point requiring especial care is to insure that it shall be dry and well ventilated. Its size will depend entirely on the number of transformers and their size that will eventually be installed. In any case it is advisable to err on the side of roominess. The walls should be double, with internal space of about 1 inch filled in with asphalt, which asphalt should be jointed to the asphalt covering of the floor. The roof may be of iron joists and concrete, of iron joists and brick arches, or a variety of other forms between which there is little to choose save on the score of cost and local convenience. Ventilation is a most important point. One of the best and simplest methods that has come under the writer's notice is to have an upcast and downcast pipe, the former near the roof and the latter near the floor, both carried up a foot or two above the ground against a neighboring wall, with a grating at the mouth. The heating of the air in the chamber by the transformers gives a steady and continuous flow into the chamber and out again. The construction of the walls and floor, with their asphalt lining, should render the chamber absolutely gasproof, and if a careful joint is made with the asphalt round the bell mouths of the incoming pipes, the only source by which gas can enter is through the pipes themselves, and these when the cables have been drawn in can be plugged with Vulcan cement. Whatever precautions are taken against gas and flooding, it is advisable that sub-stations should be inspected at least every day or two. The manhole, and the ladder to which it gives access, should be in the corner farthest away from the high tension work, and the best plan is to arrange for a small manhole for giving access to the chamber for inspection, and so on, and a larger one for use when transformers are to be taken in or out. Some designs for these manhole covers have a drip pan to prevent leakage of surface water into the chamber, but this is not really neces sary. If the cover is a fairly close fit to its frame, and beds on to a little yarn placed in the lip or groove, no appreciable amount of water will find its way through, provided that the surface of the pavement is well drained.

[To be Continued.]

## Egner's Improved Apparatus for Manufacturing Gas.

On the 10th inst., U. S. Letters Patent (No. 617,646) were granted to Mr. Frederick Egner, for "Apparatus for the Manufacture of Gas," concerning which the inventor has this to say: I have tried each of the steps of my invention, and have in practice demonstrated every one of them with satisfactory results; consequently, in presenting this apparatus to the world, I do it with confidence that all of my claims can be relied upon and established as a whole.

The following is a summary of the scope of this apparatus:

*First.—Simplicity.*—It can be readily adapted to any existing old coal gas works, and is at its worst no more complicated than an ordinary water gas apparatus.

*Second.—Utility.*—In this apparatus can be made: (a), coal gas, and by the most economical method known to date; (b), water gas, either carbureted or not, to advantage; (c), carbureted water gas, without oil, using cannels instead; (d), oil or rosin gas, with satisfactory results; (e), any combination of the above together; (f), wood gas, straight or carbureted; (g), changes from coal to water gas can be readily made by the operator at will, and thus the producing power of the plant be increased, or the reverse, from one to five-fold inside of a few minutes; (h), gas coals, coke, anthracite, and any heavy or light oils can be employed in the manufacture of water gas to advantage.

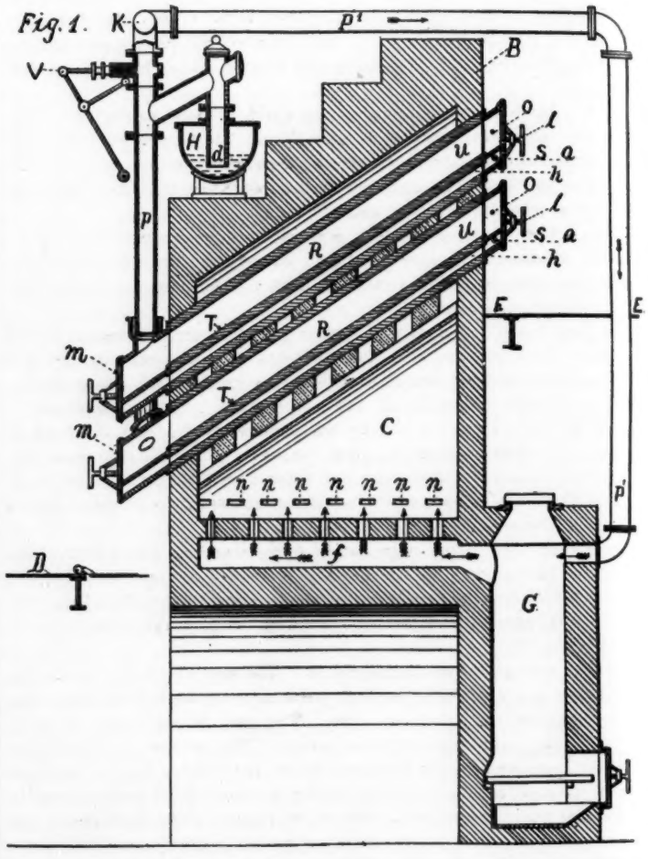
Using the words of the specification:

In the accompanying drawings Figure 1 is a vertical section of the entire apparatus in the direction of lines *x y h z*, Figs. 2 and 5. Fig. 2 is a rear end view of the apparatus above the charging floor *F E*, Figs. 1, 2 and 5. Fig. 3 is a longitudinal section, on an enlarged scale, of the upper and lower ends of the retorts, on lines *x y*, Figs. 2 and 5. Fig. 4 is a transverse section of the retorts on line *N Y*, Fig. 3. Fig. 5 is a front end view of the apparatus above the discharging floor *D*, Figs. 1 and 5. Fig. 6 is a section of the retorts on line *A L*, Fig. 4. Fig. 7 is a section of the retorts on line *Q M*, Fig. 4.

Like letters refer to like parts in all the figures.

In the combustion chamber *C* of the retort bench *B*, Figs. 1, 2 and 5, are set four retorts *R* at an inclination of about 33°. Each retort is divided into an upper and a lower chamber *u* and *h* by removable tiles *T*. Any other number of retorts may be used in like manner. The lower ends of the retorts are furnished with mouthpieces *m* and the upper ends of the retorts with mouthpieces *l*. These mouthpieces are constructed in such a manner that there can be no communication be-

Fig. 1.




tween the upper and lower chambers of the respective retorts excepting through the perforations *i* (see Figs. 3, 6 and 7) of tiles *T*, or through the joints of said tiles and between their edges and the sides of the retorts.

In the sectional view of the apparatus, Fig. 1, I have shown the retorts *R* with both ends closed by means of suitable lids or doors; but in the end views, Figs. 2 and 5, are shown two retorts open and two closed, for the purpose of assisting in a better understanding of the description of this apparatus. The lower mouthpieces of the retorts connect by means of pipe *P*, through dip *d*, with the hydraulic seal or main *H*, through which the gas may pass in the usual manner to the other apparatus and treatment common at gas works.

Above pipe *P* is valve *V*, collecting main *K*, and pipe *P*¹ (see Figs. 1 and 5), by means of which such of the gas which it is not desired to retain may be conveyed to the generator *G*, Fig. 1, to be burned or to assist in heating the retorts on the outside.

The upper mouthpieces of the retorts are provided with openings for the admission of air, steam and oil by means of suitable pipes and valves. (Shown on Fig. 2, and marked respectively, for air *a*, for steam *s*, and for oil *O*.) As will be seen by referring to Fig. 2, one opening in a mouthpiece may serve for the admission of both air and steam if the connecting pipes and valves are suitably arranged.

While the generator furnace *G*, Fig. 1, is not a part of my invention, it is necessary for the purpose of illustration to show a furnace in connection therewith. In the drawings the gas produced in the generator *G* enters the combustion chamber *C* of the bench *B* through the ports marked by arrows from flue *f*. This gas meets currents of air entering the setting in any convenient way and passing into the combustion chamber through ports *n*. The gas produced in the generator *G* is supplemented or increased by the gas periodically entering the same through pipe *P'* with the object and for the purpose previously mentioned. To make coal gas only with this apparatus, the retorts are first heated externally in any well known manner. Then a small charge of some non gas producing material sufficient to partly fill the lower mouthpieces is introduced through the upper mouthpieces of the retorts, after which a suitable charge of gas coal is placed into the re-

torts in the same way. The object of the preliminary charge of non gas producing material is to form a backing for the gaseous material to prevent waste, since the material which is in the mouthpieces is not subjected to sufficient heat to make gas. After the gas in the charge of coal has been expelled the usual course would be, if working for coal

Fig. 2.

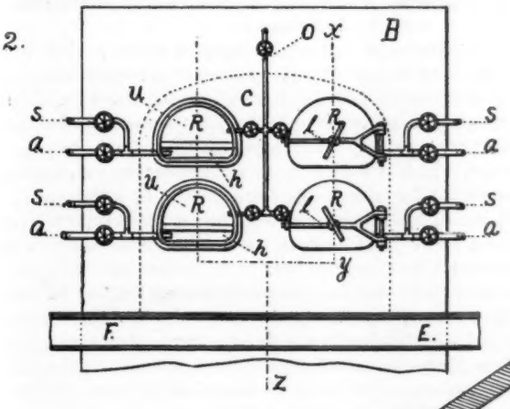



Fig. 3.

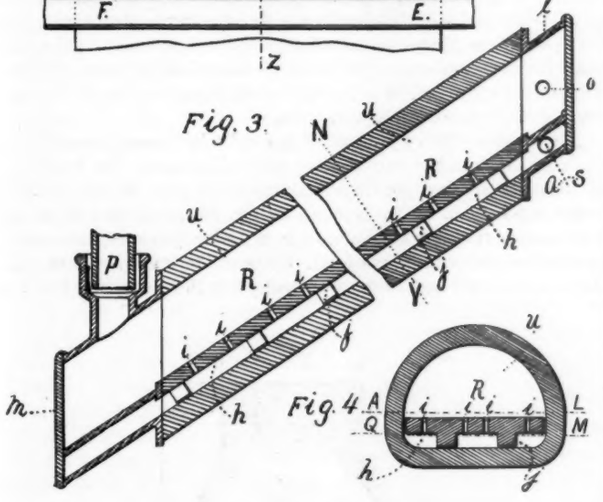



Fig. 4.




Fig. 5.

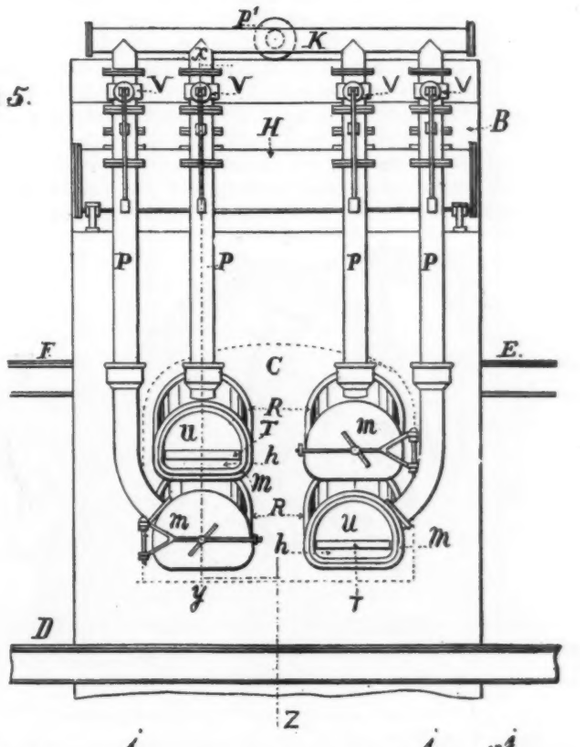



Fig. 6.

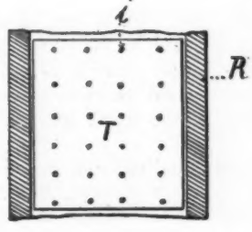
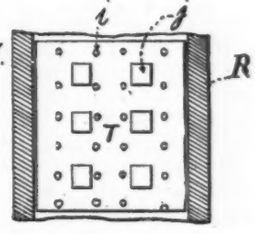



Fig. 7.




gas alone, to open the lower end of the retorts and let the resultant coke slide out, close the retort again below, and repeat the former operation; but suppose we wish to continue making gas with the material from which the coal gas has been expelled, as indicated above. Instead of removing said material we now would turn on a current of steam, which, passing into the lower chamber of the retorts, would make its way through the perforations and around the tiles *T*, up through the coke remaining from the previous operation, and, being decomposed, would form uncarbureted water gas, which may be carbureted by admitting any liquid hydrocarbon through valves and openings *O* while the production of water gas is going on. When in due time the coke in the retorts is no longer hot enough to decompose the steam and gasify the liquid hydrocarbon used, we proceed as follows: Shut off the oil and steam valves *s* and *O*, Fig. 2, and turn on air through openings and valves *a*. This air is furnished by a suitable blower (not deemed necessary to show in the drawings.) In the manner now described we heat the retorts internally, while they are also continually heated externally, as has been shown. It will be found that owing to the comparatively low fuel bed inside of the retorts and the constant heat applied at the outside by means of the furnace the retorts and fuel on the inside will be heated quickly to the necessary temperature and that the result will be a saving in fuel required for the production of water gas and also a saving in oil or any liquid hydrocarbon used to carburet the gas to any particular candle power, which latter result will, however, be due to the more even temperature which can be applied in the gasifying of the material. Now when the fuel bed within the retort has been reduced below a useful strata the same may be removed in the manner already mentioned as customary when coal gas alone is made, and then the former operation may be repeated.

Suppose we wish to make water gas from coke or with anthracite and not use gas coals. The operation of the apparatus will be practically the same as before. We would merely substitute coke or anthracite or wood, may be, for gas coals or cannel.

Movable tiles have been designed in my apparatus to divide the retorts into an upper and lower chamber, because I have found in practice that the perforated bottom of double chambered (and in that case horizontal) retorts soon clogged up, and that in opening these small holes much time and heat were lost, sometimes even the retort rendered useless for the purpose, and hence the movable perforated tile was introduced in my apparatus, since it can be quickly removed, others inserted, and the previous tiles cleaned easily at leisure. These tiles should have feet molded on them, as shown at *j*, in Figs. 3, 4 and 7.

I am aware that the use of retorts set at an incline is not new; but I do not believe that such have ever been divided into an upper and a lower chamber, as is done in my apparatus, and double chambered retorts are not new, neither the method of using steam and oil or coal, as described in mine; but such retorts have not been set at an incline and have not been provided with a readily removable partition, as described herein; but, above all, in no case has any retort or other gas making apparatus been devised like the one herein described—namely, where the retorts are heated externally constantly and internally at the same time at will with the results and object set forth. I therefore do not claim any of those well known devices; but what I claim as my invention, and desire to secure by Letters Patent, is:

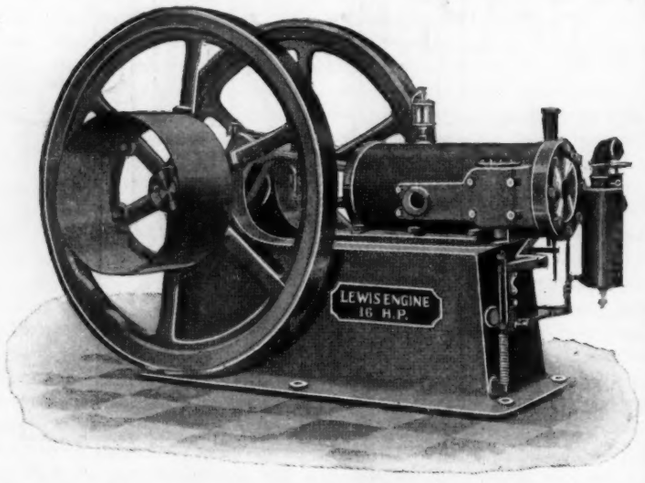
In an apparatus for the manufacture of gas, the combination of a retort furnace; a number of retorts set therein at an angle from the horizontal; each retort being divided into an upper and lower chamber by means of perforated removable tiles; means to heat the retorts simultaneously and constantly externally, and at will internally; one end of the retorts provided with means whereby oil, steam and air may be injected into them, and the other end furnished with means whereby the gas produced may be conducted either to the hydraulic main or into the combustion chamber of the retort furnace or elsewhere, substantially as shown and for the purpose described.

## The Lewis Gas Engine.

*Iron Age* says that the J. Thompson & Sons Mfg. Company, Beloit, Wis., are manufacturing the Lewis gas engine for gas or gasoline, which is herewith illustrated. This view is reproduced from a photograph of an actual 16 horse power engine fitted to use gasoline. The special feature of this engine are as follows:

The bed or base is of a design which allows the cylinder to be placed in the best possible position to do its work without causing any undue strain or tendency to springing or vibration. The base is large enough to carry the cylinder almost its entire length, instead of being extended, as is the case in many other engines. This manner of placing the cyl inder is the best, and although this arrangement is the more expensive to build it is considered cheaper to the purchaser in the long run. The bed is high enough to clear the wheels of the foundation.

The cylinder is cast separate from the bed and may be removed in case it is desired to do so. It is made from close grained refined iron,




and is accurately bored, finished and fitted. Great care is also exercised in the proper alignment of the cylinder and other working parts. The cylinder is cast open at both ends of the water jacket, so that the head and front ring can be easily removed and the water jacket cleaned out from lime or mud. The piston is of the trunk type and may be easily removed when desired.

The crank shaft is of open hearth steel, milled from one piece, contains no welds, and is amply heavy to carry the weight of flywheels and will not spring under the heaviest load the engine may be called upon to carry. The crank is machine finished over all. The main crank bearings and bearings in connecting rod are of unusually large proportions and are made of phosphor bronze, which experience has shown to be the best metal for this purpose. This construction and the efficient means for oiling provided reduce the liability of hot journals to a minimum.

The mechanism which operates the two valves and other moving parts is very simple and not liable to get out of order. All the working parts, excepting the two valves, are in plain view of the operator, are easily accessible and none of them is frail or delicate, or likely to get out of order. All parts of the engine are made interchangeable, so that any parts becoming broken by accident or carelessness may be replaced quickly.

The governor is of the well known automatic type, and peculiarly adapted to gas engine use. The operation of the governor is one of the distinctive features of the Lewis, and its action is such as to control the amount of fuel admitted into the engine, instead of entirely closing the inlet valve and allowing the engine to run several revolutions between impulses, as is common with other types of gas engines. The main exhaust in this engine is the first, which occurs at the end of the stroke, through a port uncovered by the piston. Through this port most of the burned product escapes, thereby relieving the engine of pressure at the proper time and leaving very little heat to pass out through the valve. Since the engine is relieved of pressure before the exhaust valve opens, the valve requires little power to raise it, and as there is very little heat passed out through the valve there is no annoyance from burned out exhaust valves. The exhaust chest is completely water jacketed. Another advantage secured by this method of exhaust is in greatly reducing the usual objectionable noise.

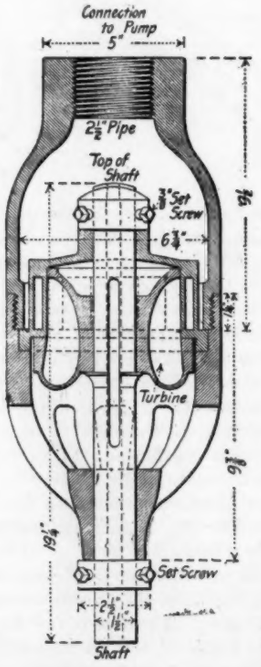
The mixer is a distinctive feature of the engine. The gasoline is pumped from a tank placed outside the building into the mixer, where is retained only sufficient to supply the engine; the excess overflows and returns to the tank. The operator does not regulate the gasoline, but regulates the air supply according to the grade and quality of the gasoline and the atmospheric conditions. In this way can always be secured a perfect mixture of air and gasoline, no matter what the weather conditions may be. The air regulating devices are very simple. Persons unfamiliar with gas and gasoline engines sometimes ask if there is any danger of the engine exploding. The Lewis engines are perfectly safe in that respect, because it is not possible to get enough gas into a cylinder to cause a rupture. Too much gas will make no explosion at all.

## The Culnane Hydraulic Pile Sinking Machine.

*Engineering News* says that in sinking piles at the harbor improvement works at Owen Sound, Ont., very successful results were obtained from the use of a machine used to bore a hole for the pile. This machine was designed as an improvement upon the method of sinking the piles by means of a water jet from a pipe at the side of the pile.

The machine, which is shown in the accompanying cut, consists of a vertical metal cylinder with hemispherical ends, 6¾ inches inside diameter and 17⅝ inches high over all. The shell is made in two parts, put together with a screw joint, and at the middle is a partition or diaphragm, forming a turbine chamber. The hollow boring bar or shaft extends up through the diaphragm, and has a cap bearing on the upper side. On the upper end of the shaft is secured a turbine wheel, while at its lower end it is fitted with a pair of rectangular blades, set spirally; but these blades are not shown in the drawing. At the top of the machine is a connection for a line of wired hose from a duplex steam pump, with cylinders 14 × 7 × 10 inches, supplying water under a pressure of 100 pounds per square inch.

The water in the upper part of the cylinder passes down the side of the turbine chamber and through suitable ports to the turbine, which is caused to revolve, together with the shaft and cutting blades. The waste water from the turbine passes into the lower part of the cylinder and escapes through bottom openings under pressure, thus serving to loosen the surrounding material. Some of the water also passes through the hollow shaft and forms a central jet at the bottom. The machine




is lowered from the pile driver and cuts its way to the required depth. It is then quickly drawn up, and the pile (hanging ready in the leaders) is dropped in and sent home with a few taps of the pile hammer.

On the work at Owen Sound, rock elm piles 12 by 12 inches, 40 feet long, were driven at first with an ordinary pile driver having a 2,000-pound hammer falling 20 feet. The piles were pointed, but did not drive easily. In a test, after 200 blows had been given in from 35 to 40 minutes, the pile split at the head, and a piece was sawed off. After 15 more blows the pile refused to move, leaving 3 feet 3 inches to be cut off above the given level. With a hydraulic boring machine a similar pile was put down in 3 minutes, being settled first by the dead weight of the hammer, and then by a few blows with a fall of not more than 2 feet. By this method 80 to 100 piles were driven to a depth of 20 feet in a working day of 10 hours.

This machine is the invention of Mr. J. C. Culnane, of Fairport, Ont., who was one of the contractors on the protection works, and is now arranging to introduce it in this country.

## The Recovery of Bye-Products.

*Engineering* says it has long been the fashion at the opening of new technical schools or at the annual distribution of prizes and diplomas by statesmen, prominent or otherwise, to emphasize the assertion that there is wealth in the utilization of bye-products from our various trades and manufactures, and the case of the preparation of so many useful dyes from that erstwhile waste material, coal tar, is always taken as exemplifying this. Now this particular illustration is undoubtedly a very apt one, but we think that the continual harping on this string is becoming rather out of place in these changed days. No doubt there are numbers of more or less dirty or noxious effluents leaving our chemical dye and bleach works to spoil our once pellucid streams, but to the practical business man the task of purifying these streams does not always present itself in a rosy aspect. The fact is, times have changed a good deal in the chemical trades, the prices, especially of heavy chemicals, have been now for some years on the down grade, and many substances that it would have paid to recover some years ago can now be bought pure for a less sum than it would be necessary to spend in plant and labor in order to recover them from the effluents of which they may form a component part. And just as the prices of so many chemicals have fallen owing to competition and over production, the cost of labor and the risks under compensation acts and so forth have increased, giving therefore further reason for the growing disinclination of chemical firms to go in for recovery. To take the problem of sewage disposal, the question of the market price of the various manures is an all-important one.

Sanitarians are never tired of preaching the doctrine of waste of vital substance, and of calling the nation to task for its supineness in allowing valuable ammonia to run to waste from our sewers, or to escape into the air from our coal fires. But we think it has now come to be generally recognized by practical men that the idea of a sewage works being worked on a profitable basis as a manure factory, instead of as a dire necessity to be supported by the rates, is very much of a fallacy; because the strongest and best manures, such as ammonium sulphate and nitrate of soda, to say nothing of mineral phosphates, can be obtained at a cheaper rate. Many people appear to think that provided you get your raw material for practically nothing, it must pay to use it for manufacturing purposes. We, however, have had a good deal of experience to the contrary. Waste products are rarely pure. They are generally mixtures, often of a complicated nature, and when the constituents have been separated as pure substances, or at any rate in a form fit for sale or capable of being used as a raw product, it is frequently found that it has cost more than it would have cost to purchase the stuff in the open market.

To take one or two instances out of a large number that could be mentioned, we wonder how much mental exertion, not to speak of patent fees, has been spent in the endeavor to utilize profitably the waste pickle liquor from galvanizing works. This liquor, consisting principally of proto chloride of iron and free hydrochloric acid, is naturally a great nuisance in the watercourses into which it enters; but iron salts and acids are cheap enough now, and it really does not seem possible to make the recovery of these a financial success, especially if the districts in which this liquor is produced are remote from the chemical works where it might be treated profitably if it was obtained without the cost of carriage. Again, in those indiarubber works where elastic thread is manufactured, there is a considerable amount of caustic soda employed for removing the excess of sulphur used in the vulcanization process. The dirty caustic liquid containing sulphur in combination is now run to waste in the watercourse or sewer, where, if it should happen to meet with any effluent of the kind last mentioned, the atmosphere is impregnated with that very disagreeable gas, sulphureted hydrogen. It may seem a pity to run this caustic liquor to waste, and no doubt the caustic soda could be recovered, but by the time it has been purified from sulphur and resinous bodies, it will have cost more than to buy fresh soda, the price of which, at the present time, is only about one-third of what it was 15 or 20 years ago.

With regard to the material loss arising from the non-recovery of benzol and ammonia from coal smoke, certain enthusiasts are never tired of enlarging eloquently. It is easy, however, to foresee an overproduction if this recovery was really carried out on the scale proposed. Already a large amount of benzol is recovered, more especially in Germany, from coke ovens and coal gas, and the result is that the material is now down to what the makers, at any rate, consider unremunerative prices. The price of this article certainly has fluctuated a good deal in the last five years, going from $1 a gallon to 25 cents, then up to 75 cents, and down again at the present time to less than 25 cents a gallon; but this has been due to special demands, and unless the makers form a combination, there seems no reason to suppose that the price will be very high again. This fluctuation in the price of tar products naturally causes perturbation in the minds of those coke manufacturers who have adopted the costly high-pressure ovens, and who hope to recoup themselves by the sale of the bye products; and if the profit from this source sinks to a low figure, it is hardly likely that coke manufacturers will go in largely for recovery ovens, the first cost of which is so much higher than in the case of the beehive type. Of course, there is plenty of scope for sulphate of ammonia in agriculture, but its use by farmers has not advanced by leaps and bounds, though progress may fairly be expected with the advent of technical education.

With regard to the recovery of tar and ammonia from household fires, a project suggested a year or two ago at a Congress of the Sanitary Institute, it may not be out of place to point out that in household fires, with their large excess of air supply, the tar which might be condensed from the smoke belongs not to the valuable benzine series of hydrocarbons but to the paraffines, and such being the case, it is difficult to see how it could have any value which would at all compensate for the cost of collection. This class of tar is produced in the low pressure coke ovens, and it is utilized principally as a component part of colliery grease. Again, with regard to the ammonia, it has been shown that when coal is properly burned in a current of air, the nitrogen is evolved in the free condition, and not as ammonia at all. We mention these facts as illustrative of the lack of special knowledge displayed by many public speakers in reference to scientific matters, and especially to the subject which is under our present notice.

Of course, changed times and seasons form an important factor in this question of recovery. Apart, perhaps, from a compulsory abatement of a nuisance, the recovery of bye-products is only likely to take place when it pays to do it, and no doubt when cheap enough processes have been devised many chemicals will be recovered that now run to waste.

In what we have said we are far from wishing to be taken as asserting that the recovery of bye-products generally is a mistake or a delusion, because, of course, in a large number of cases it has proved not only of great hygienic importance, but also of considerable commercial value. Of late years perhaps the best example of the recovery of a useful body from a noxious waste material has been that of sulphur from alkali waste, the accumulation of which in our chemical centers had for so long been a source of annoyance, but from which there is now produced sulphur of the greatest purity. Other problems, such as the utilization of the vast slag heaps that surround our blast furnaces, remain for the chemist of the future to solve, though such processes will have to prove to be profitable before they receive any attention from the manufacturer or capitalist. It must not be overlooked that successful businesses are carried on by individuals for their personal advantage, and it would be difficult to find a manufacturer of sufficiently Benthamite views to work at a loss in order to restore the pristine purity of a river or to relieve the country side of an eyesore.

## The Penetration of Beams of Light.

By Mr. Buckner Speed.

As a ship moves away from a beacon light it is noticeable that the apparent intensity of the light becomes less brilliant as the distance increases. It would be naturally supposed that this diminution would follow the law of inverse squares. Such, however, is not the case, nor is the rate of diminution even a smooth curve. It has been frequently noted that the brilliancy of the light decreases rapidly in the early part of the time of departing from the light, more rapidly than the second power, in fact; but when a certain distance and brilliancy of appearance are reached the brightness of the light remains constant for a long distance of increased departure, this flat place in the curve of decreasing brightness again breaking off into a rapid fall and final extinction of the light due to distance and opacity of the atmosphere.

This maintained equality of a distant light which the observer is leaving is well known to lighthouse authorities, and the following is quoted from a former member of the United States Lighthouse Board: "As a person retires from a light its apparent intensity diminishes for a certain distance; beyond this the light appears to be steady for a very long space. The point at which the reduction ceases is called the limit of punctual vision."

The explanation for this curious phenomenon, which has suggested itself to the writer, is that during the first rapid decrease of brilliancy the iris of the eye is contracted as far as its structure will allow, and

the eye is receiving light on the retina in proportion to the brilliancy of the light. As the distance from the light increases the light continues to lose in brightness until the iris is not so severely tried and begins to open. Then the opening of the iris to a certain extent compensates for the diminishing of the light by admitting an increased volume. When the iris has opened to its fullest extent the compensation ceases, and, the aperture of the eye remaining constant, the light is seen to rapidly diminish, following the law of squares and aided also by the opacity of the atmosphere.

If the case of the actual (not the physiological) rate of diminution of the light is considered, under the ordinary condition of not perfectly transparent air, a set of interesting modifications of the text-book law —that the intensity of light varies inversely as the square of the distance from the light—are found to follow.

Take, for example, a perfectly collimated—that is, parallel—beam of light. Were the air perfectly clear and homogeneous, the intensity of the beam would be undiminished by distance.

Let the beam, however, be shining through atmosphere which will diminish its brightness $q$ per cent. in unit distance, or what is the same thing, will allow $p$ per cent. to pass through unit distance. If at the reference point the intensity of the beam is $I$ and the permeability of the air is $p$ per cent., then the intensity $i$, at distance $x$, will be

$$i = I p^x \text{ or}$$
$$\log i = \log I + x \log p.$$

And if the light emanates from a small point and its intensity at unit distance is $I$, the expression becomes

$$i = \frac{I p^x}{x^2} \text{ or}$$

$$\log i = \log I + x \log p - 2 \log x.$$

Further, in the case of a searchlight in which the angular divergence of the beam is between 2° 30′ and 3°, and the beam is a truncated cone, with the smaller end starting at the mirror of the reflector, let the angle of the divergence of the beam be $a$, then the distance behind the mirror to the virtual apex of the cone prolonged will be

$$f = \frac{d}{2 \sin \frac{1}{2} a}$$

$d$ being the diameter of the mirror measured in the same units as $f$, and

$$i = \frac{f}{(f + x)^2} I p^x$$

These formulæ will hold true for conditions of homogeneous permeability, as for a horizontal beam on a still night when there are no broken strata of fogs.

On the other hand, if $p$ vary, and can be made to be $p = f(x)$, that is, a function of $x$

$$i = I f f(x) d x,$$

and the other above equation will take the same form, involving an integration to reach the factor $p$.

## A Symposium on Pipe Lines.

*Engineering Record* reports that the last monthly meeting of the New England Water Works Association, held in this city early this month, was noteworthy for a number of valuable papers on pipe lines for water works. The first was by Mr. Dexter Brackett and described the new cast iron pipe used by the Metropolitan Water Board in Boston and the vicinity. Mr. Brackett stated that the growing practice of employing sheet steel for large mains was carefully considered before the distribution system of the Metropolitan works was finally determined. It was found that the thinness of the shell of such pipes rendered their life practically dependent on the protective coating, and where they had to be laid in traveled streets it would be difficult to keep the pipe from being injured, especially in such crooked and busy thoroughfares as those of Boston. In such streets there would be many delays in using riveted pipe, which would cause the total cost to be unusually great, and it would also be impractical to expose much of the pipe for testing. Consequently, cast iron was adopted except in case of bridge or river crossings.

Having determined upon the class of pipe the thickness was next settled. Where the total length of the distribution system is small this subject is not so important, but where 75,000 tons of pipe must be used, as in this case, it amounts to considerable. There has been a tendency toward thinner pipe. In mains of small diameter, built with a factor of safety of five, the theoretical thickness is very small, only about 0.1 inch for a 6-inch pipe under a pressure of 100 pounds. Allowance, however, must be made for water hammer, imperfections in the castings, deterioration of the metal and other causes which it is unnecessary to enumerate, so the following formula was adopted to give the thickness in inches:

$$t = \frac{\text{(Stat. press. + hammer) rad.}}{3{,}300} + \tfrac{1}{4}.$$

The radius in this formula is expressed in inches. The water hammer was taken to vary from 70 pounds in the case of pipe 42 to 48 inches in diameter, 90 pounds for a 20-inch pipe, and 120 pounds for those from 3 to 10 inches in diameter. The thickness given by the formula is less than that used ordinarily in Boston and the vicinity. About 80 per cent. of the pipe used by the distribution department of the Metropolitan water works is from 36 to 60 inches in diameter.

Much care was taken in the details of the manufacture of the pipe. The iron was tested by bars 2 by 1 inch in size, broken by transverse loads; the metal was required to have a strength of 19,000 pounds per square inch, and to deflect 0 3 inch before breaking. There was some difficulty at first in obtaining metal of this strength, but the later bars stood 23,000 to 24,000 pounds and deflected from 0.4 to 0.45 inch. About 5,000 bars were tested in all. Care was taken to have the inside of the pipes as smooth as possible. The surface of the inner core of the mold was painted with a mixture of coal dust and molasses, which was put on with a brush at first. It was found that the brush marks showed on the inside of the pipe, so in later work the core was revolved as in a lathe and the coating applied and smoothed down much as a piece of wood so mounted is polished.

Many experiments were made to find a coating for the pipe which would be better than tar, but the results were all negative and did not warrant any change. At some ovens one end of the pipe is hotter than the other when dipped, and the result is that one end is burned while the other is not hot enough. This is injurious because the coating will not dry on cold pipe and is over-distilled when applied to pipe which is too hot. The common practice is to immerse pipes in the dipping bath for from 30 to 120 seconds. The pipe for the metropolitan water supply was required to be kept in the bath for 5 minutes. The material for the coating is usually coal tar. Some plants obtain the tar directly from gas works, some use dead oil for thinning and some use fresh tar for this purpose. The interior surfaces of all pipes 36 inches or more in diameter were painted with paraffine varnish and vulcanite, as an additional protection, as they were unloaded at the pipe yards. This material dries more slowly than ordinary paint.

The second paper was a description of a new steel force main for the New Bedford water works, and was presented by Mr. George S. Rice. This main is 8 miles long, 48 inches in diameter, and made of steel plates 5 16 inch thick. The pipes come from the shops in lengths of about 30 feet and were put together with telescopic joints. A railway track was built for 4 miles along the line of the main and facilitated its construction very much. The pipe was coated with asphalt applied at a temperature of 300° F., and at some places with P & B paint.

Careful experiments were made to determine if there was any expansion in the pipe after it was laid. The experiments were made under a range of temperature of 40°, with air circulating through the pipe. No change whatever could be noticed where the sections were covered with earth, but where they were exposed there was some motion evident. About a mile and a half of the main was laid on piles through a swamp; the piles were capped and the pipes rested on these caps. Manholes were put in every 500 feet, and eight air valves were placed along the line. There is 70 pounds static pressure at the pumping station.

The line was tested with water in lengths of 2,000 feet and left full for four or five days at a time; in some cases for even two weeks. At one time, when a heavy rain came on, the contractor let the water out of a section of the pipe and 400 or 500 feet floated in consequence. In all the tests only one leak was found large enough to be photographed. All the curves on the main, the sharpest being a 6° curve, were made in the shops.

The third paper was by Mr. L. M. Hastings, City Engineer of Cambridge, Mass., on the use of steel in water mains. He believed it would be advantageous to use this material in pipes 24 inches or more in diameter, and in the leading mains supplying outlying districts of a city. The advantages of steel are its economy in first cost, relative freedom from breakage in service, and adaptability for special situations, such as river crossings.

As for the first point, economy in first cost, Mr. Hastings stated that the 36-inch cast iron main laid in Rochester in 1892 cost $6.21 per foot, while the 38-inch steel main cost but $5.84. At Cambridge a 40-inch steel main saved 31½ per cent. of the estimated cost of a cast iron pipe of the same size. At New Bedford the saving was 23 per cent. in the case of 48-inch pipe. At Minneapolis the saving is estimated at 28 per

cent. in the case of a 50-inch main, and at Duluth it was believed to be about 33 per cent.

In regard to the discharging capacity of pipes Mr. Hastings pointed out that many experiments made with cast iron mains show that after a few years there is a marked diminution in their capacity, owing to tuberculation. As for steel pipes there have been very few experiments, but it seems to be true that their poorer showing as regards discharging capacity compared with cast iron mains disappears more or less in the course of time. As an illustration he referred to the pipe at Cambridge, Mass. It was estimated that a 40-inch cast iron main having a coefficient "c" of 105 would be equivalent to a 42 inch steel pipe having a coefficient "c" of 90. The steel pipe was selected. It cost $116,119, or about $4.81 per foot. It weighed 7½ pounds per foot more than the iron pipe, and length for length was 5 per cent. more expensive; consequently, the saving of 31½ per cent. previously mentioned should be reduced to 26½ per cent.

As regards protective coatings Mr. Hastings believed that steel should be more carefully treated than cast iron. On this subject he referred to the interesting experiments made at Cambridge and described very fully in the "Transactions" of the American Society of Civil Engineers for December, 1896. The durability of the steel mains was considered to be somewhat less than that of cast iron pipe, but not enough to amount to anything.

The concluding paper was a description of the new salt water fire protection system in Boston, which was presented by Mr. Frank A. McInnis. A 12 inch cast iron main has been run from the water front to the Post Office and then back over a different route to the water front again. This pipe is 5,000 feet long. At each end it branches into two 10-inch pipes which divide into six 3½ inch pipes. Hydrants are placed about 300 feet apart and there is an electric signal system connecting them with the water front, where the fire boats are attached, and with the fire headquarters. The system was described in the *Engineering Record* of January 8, 1898, and for that reason need not be further reviewed here.

The meeting was an unusually enjoyable and profitable one, and the presentation of the papers was rendered more attractive than usual by a large number of lantern views. President Forbes, Secretary Whitney and the other officers of the Association are to be congratulated on the results of their labors in organizing these meetings devoted to a single subject. It was determined during the business session to hold the fall convention at Syracuse, in response to the earnest invitation of Mr. William R Hill, engineer and superintendent of the water works of that city.

## ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. SAMUEL BOILEAU, prominent in the management of the Easton (Pa.) Gas Company for 27 years, and its President since 1883, has resigned from active connection with that Company. His successor on the Board of Directors is Mr. M. H. Jones.

THE Lexington (Ky.) Gas Company's last dividend of 2 per cent. is payable on demand.

THE annual meeting of the shareholders in the New Orleans (La.) Gas Light Company was a most harmonious gathering, and a delectable feature thereof was an elaborate luncheon. The Directors chosen were: Messrs. A. H. Siewerd, R. M. O'Brien, James Jackson, A. B. Wheeler, A. Baldwin, Frank T. Howard and Alden McClellan.

MR. CHARLES L. TAYLOR will retain his position as Gas Inspector for San Francisco for another term of two years, despite Mayor Phelan's attempt to have him superseded.

A RATHER mysterious corporation we are advised has been chartered in Norfolk, Va. Its title is that of the Quincy Gas and Light Company, and its proposal is to operate "lighting and industrial properties in New York." Its capital is said to be $100,000.

ASSEMBLYMAN STREIFLER has introduced a bill in the lower branch of the New York Legislature providing that gas companies which require a deposit of $10 or over when a gas meter is placed in a dwelling shall pay interest on the deposit at the rate of 6 per cent. per annum.

THE proprietors of the Cicero Gas Company, of Oak Park, Ills., have placed an order with the Riter-Conley Mfg. Company, of Allegheny, Pa., for a double lift gasholder rated to contain 500,000 cubic feet. The holder is to rest in a steel tank, to be 114 feet diameter and 28 feet deep.

THE Directors named to manage the affairs of the Cranford (N. J.) Gas Light Company are: George Kyte, Henry Wardell, George A. Totten, John Kean and Thomas O'Neill.

THE Keene (N. H.) *Sentinel* says that acetylene gas, as used in the adjoining town of Winchester, is not giving as good satisfaction as was expected from the representations of the agent who put in the plant, and some of the consumers have given up its use on account of the high cost.

AT the annual meeting of the shareholders of the Dover (N. H.) Gas Light Company the following officers were chosen: Directors, John F. Hill, William T. Cobb, Arthur L. Bates, J. Frank Lang and George Severance; Clerk, T. B. Garland.

ADVICES by way of Philadelphia, dated Jan. 15th, are to the effect that the residents of Ocean City, N. J., which is a neighbor of Sea Isle City, are much agitated over the granting of a franchise for the erection of a gas plant and its operation in Ocean City, to Mr. E. H. Longstreth, of Camden, N. J. It is claimed that the ordinance was railroaded through Council at a special meeting thereof, and that the residents of Ocean City were not given a chance to be heard in the matter; the measure, it is complained, came before the City Council one night and passed the following night. Our informant adds: "The hundreds of Philadelphians who own property at Ocean City are greatly displeased, it is understood, with the Council."

MESSRS. J. S. Adair, W. E. Jakway and Warren Pratt, all residents of Kearney, Neb., have purchased the plant and franchises of the Kearney Gas Company. The concern has been reorganized, and it will hereafter be known as the City Gas Company, with Mr. Warren Pratt as Manager.

MR. W. S. BOWEN, the Manager of the Newport News (Va.) Gas Company, is planning a system of main extensions that will eventually give to the residents of Hampton a gas supply.

THE following is from a recent issue of the Williamsport (Pa.) *News*: "At the annual meeting of the stockholders in the Williamsport Gas Company the following Directors were e'e:ted: Harrison E. Gawtry, Wm. H. Male, Frank Tilford, Henry C. McCormick, John G. Reading, F. Sherwood Male, Henry R. Wilson, L. B. Gawtry and Thomas W. Stephens. The usual routine business was conducted, but owing to the absence of Attorney General McCormick several matters which had been held over for action until the time of the meeting had to be deferred for a short time. No action was taken on the price of gas, and when the matter was called to the attention of Superintendent Lane he said: 'The absence of President McCormick prevented action in that respect. It is the desire of the Company to reduce the price of gas as soon as the conditions warrant. We expected to have our new holder and other improvements on the plant completed by January 1st, so that with our perfected facilities we could furnish gas at a lower price to consumers. Owing to the magnitude of the work we found ourselves unable to effect the change as soon as we hoped. The people of Williamsport have been promised cheap gas, and they are going to get it, but we must have time to get our improvements, which have been and are being made at great expense, in good working order.' Supt. Lane also stated that the Company intends to extend its mains this spring to South Williamsport. Owing to the largely increased patronage in Newberry, new mains will also be laid in that section of the city."

MR. SAMUEL H. EGOLF, who is the virtual owner of the properties of the Spring City Light Company, of Royer's Ford, Pa., proposes to form a corporation ownership thereof. The works will be rebuilt on coal gas lines this spring. Mr. J. A. Nix, who has been the lessee of the plant, is to be retained as Superintendent, and Mr. Elwood Egolf (a son of the owner) is to act as Secretary and Treasurer.

ARTICLES have been filed with the Secretary of State of New Jersey, which announce the consolidation of the Bergen County Gas Light Company, of Englewood, with the Englewood Electric Light Company. The name of the succeeding corporation is to be that of the Englewood Gas and Electric Company, which is capitalized in $400,000 and bonded in $200,000. The officers of the concern are: President, Frank B. Poor; Vice-President, George W. Conklin; Secretary and Treasurer, W. C. Thomas.

AT the annual meeting of the New Albany (Ind.) Gas Light and Coke Company the following officers were chosen: Directors, J. K. Woodward, S. A. Culbertson, J. W. Dunbar, W. H. Welman and G. H. Devol; President, J. K. Woodward; Vice-President, J. W. Dunbar; Secretary and Treasurer, Jas. O. English; Superintendent, J. W. Dunbar.

MR. WILLIAM W. RAND, for many years connected with the Minneapolis (Minn.) Gas Company, died at his home in that city the morning of the 11th inst. He was in his 46th year.

SECRETARY OF STATE KINNEY recently issued a charter to the Bellevue (Ohio) Gas Company, on the petition of Messrs. Isaac C. Baxter, of Detroit, Mich; Jno. R. Lynn, of Port Huron, Mich.; Joseph P. Degnan and Wm. E. Rooney, of Toledo, Ohio, and C. R. Callaghan, of Bellevue, as incorporators. The Company is capitalized in $40,000. At the organization meeting the following officers were chosen: Directors, John R. Lynn, Joseph P. Degnan, John McMillen, Thomas Molland and C. R. Callaghan; President, John R. Lynn; Vice-President, C. R. Callaghan; Secretary, Treasurer and Superintendent, John McMillen. Our correspondent thus details the purposes of the Company's owners: "The principal owners of the Bellevue Gas Company are, as you know, practical gas men of years of experience, and it is their intention to erect and equip the plant with only the best modern machinery, and to supply their patrons with a first class gas fuel at a price that will allow of its consumption by all. The office and salesroom of the new Company will be in the Molland block. To accommodate the Company the owner of the building will extend his building 40 feet, putting two additional stories on the extension. The Company proposes to maintain a salesroom in which will be displayed a complete line of gas stoves for cooking and heating, improved burners, fixtures, etc." The Company it is thought will be able to supply gas by April 1.

AT the organization meeting of the Directors of the Hartford (Conn.) City Gas Light Company the following officers were named: President, James L. Howard; Treasurer and General Manager, John P. Harbison; Secretary, Thomas Evans.

A CORRESPONDENT forwards the following from Louisville, Ky., under date of the 13th inst.: "The report of the arbitrators to fix the price of gas in this city, for the period of 1889-1903, was sent to the General Council last night. It states that the arbitrators are not justified in imposing upon the Louisville Gas Company a reduction in the price of gas from the price now existing. It does, however, impose a reduction in the price of gas for city street lamps; but this affects both the Gas Company and the city very little, as there are at this time only 21 lamp posts in commission. The price is not reduced on gas to general consumers and the city for other purposes than public street lights. The arbitrators give reasons at length for their decision. Mr. J. P. Claybrook, for the city; Mr. R. Montfort, for the Gas Company, and Mr. E. C. Lewis, a non-resident, are the arbitrators, and their report is of the date of January 6, 1899. They quote the laws applying to their mission, and then say they have had the books of the Louisville Gas Company examined by an expert accountant, Mr. Ben. C. Weaver, who reports in detail the operations of the Company for the years of 1894, 1895, 1896, 1897 and nine months of 1898, that is, through September of 1898. The arbitrators say they have visited and examined the gas and electric light plant and have verified charges to the construction account by improvements found, to the total of $275,229.65. It was decided to determine the price of gas by basing it on the net earnings, for the five years mentioned above. They say the capital stock prior to 1894 was $3,000,000, and was increased in 1894 to $3,600,000. The price must be fixed to yield the Gas Company more than a profit of 8 per cent. per annum on the par value of the capital stock, provided the price of gas to private consumers (including the city, except for street lamps) must never exceed the maximum rate fixed for the first five years by the Company's charter, nor more than shall yield the Company the 8 per cent. profit. The arbitrators say: On the $3,600,000 of capital stock the percentages of net earnings are as follows:

| | |
|---|---|
| 1894—$252,201.13 | 7.01 per cent. |
| 1895—$243,536.21 | 6.76 " |
| 1896—$215,644.91 | 5.99 " |
| 1897—$221,530.45 | 6.15 " |
| 1898—$155,557.93 | 4.32 " |

These earnings, as shown by the books of the Company, are:

| | |
|---|---|
| 1894—$250,444.95 | 6.96 per cent. |
| 1895—$234,825.80 | 6.50 " |
| 1896—$200,706.99 | 5.57 " |
| 1897—$213,297.93 | 5.93 " |
| 1898—$149,223.76 | 4.14 " |

The difference between these two statements is fully set forth in Mr. Weaver's report. In Mr. Weaver's report is the statement that the difference in the net totals is caused by the Company charging 'depreciation of street lamps to an expense account.' The arbitrators go on to say that the average percentage of net earnings for the four years and nine months is but 6.36 per cent., and the highest but 7.01 per cent., so the arbitrators can make no change in the price of gas to private consumers, etc., from that now prevailing, namely, $1.35 per 1,000 cubic feet of illuminating gas, less 5 cents per 1,000 cubic feet for payment of bills within 5 days after they are due, and 50 cents per 1,000 cubic feet for fuel or non illuminating gas. The statement of the arbitrators in regard to the fuel gas is taken from the report, but it is plainly an error, for the price of fuel gas is 80 cents per 1,000 cubic feet, less a discount of 5 cents per 1,000 cubic feet for prompt payment of bills. The price of gas for city street lamps is, however, lowered by the arbitrators in the absence of restrictions. It is fixed at $14.43 per lamp per annum, a reduction of $3.04 from the price per lamp per annum fixed by the last board of arbitrators' price. However, the statement is made that the city has only 21 such lights in use. Arbitrators also checked off accounts of the Gas Company on various accounts."

ASSEMBLYMAN GROSSMAN is responsible for the introduction in the New York Legislature of a bill which puts the gas rate in New York City at $1 per 1,000 cubic feet on ordinary account, the rate on public account to be 75 cents per 1,000. In connection with these "reduction" measures the hint is here given that it would be well to watch the course of the Committee on General Laws, of the Assembly, in relation thereto.

AT the annual meeting of the Lexington (Ky.) Gas Company the officers chosen were: Directors, H. C. McDowell, T. D. Mitchell, J. M. Duff, E. H. Bacon and A. B. Lancaster; President, Alex. Jeffries.

THE Directors named by the shareholders of the Niagara Falls (N.Y.) Gas Light Company at their annual meeting were: Harriet J. Brewster, Louis A. Boore, E. Brewster, Gilman N. Perkins, H. L. Brewster, Haywood Hawkes and Peter A. Porter.

ON the 26th inst. the shareholders of the Clyde (N.Y.) Gas and Electric Company will hold their annual meeting, at which session the stockholders in the Clyde Electric Company will exchange their scrip for stock in the Clyde Gas and Electric Company.

AT the annual meeting of the Consolidated Gas and Electric Company, of Batavia, N. Y., the following result was reached: Directors, E. O. McNair, S. D. Purdy, J. P. Casey and O. C. Steele; President, S. D. Purdy; Vice-President, E. O. McNair; Secretary, R. L. Kinsey; Treasurer, John Thomas.

ARRANGEMENTS for the consolidation of the gas and electric lighting interests of Decatur, Ala., have been completed.

THE Directors named to rule the affairs of the Dansville (N. Y.) Gas and Electric Light Company for the ensuing year were: J. B. Morey, George A. Sweet, J. M. Edwards, B. H. Oberdorf and C. A. Ross.

THE smiling countenance of Mr. Andrew K. Quinn, the astute Treasurer of the Newport (R. I.) Gas Light Company, was a picture, when, at the Company's annual meeting, the reports of its accomplishings during the past twelvemonth were read. The figures showed that a large business had been done, and the deductions went to indicate that 1899 would even exceed 1898. The officers elected were: Directors, Henry Bull, Thomas A. Lawton, Melville Bull, Frederick Tompkins and Andrew K. Quinn; President, Henry Bull; Treasurer and Superintendent, Andrew K. Quinn; Secretary, Thomas A. Lawton.

IT is proposed to construct a gas works in the village of Exeter, Cal. The place is too small to support such an enterprise.

THE authorities of Alexandria, Va., the gas works at which place are in the public control, have virtually determined to reduce the selling rate to $1.25 per 1,000 cubic feet—a concession of 15 cents.

THE Directors of the New Haven (Conn.) Gas Light Company have perfected the following organization: President, Andrew W. DeForest; Vice-President, Pierce N. Welch; Secretary, Gardner J. Morse; Treasurer, Isaac J. Wild; Superintendent, Freeman C. Sherman.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

PUBLISHED ON EACH MONDAY OF THE YEAR AT

**No. 32 Pine Street, New York.**

The JOURNAL is the official organ of the
NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.
AMERICAN GAS LIGHT ASSOCIATION.
WESTERN GAS ASSOCIATION.
OHIO GAS LIGHT ASSOCIATION.
PACIFIC COAST GAS ASSOCIATION.

TERMS:

SUBSCRIPTION—Three Dollars per annum, in advance. Single copies, 10 Cents.

*Notification Respecting Advertising.*—Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co., 39 and 41 Chambers St.
*Germany*—Lemcke & Buechner, of New York.
*England*—Aug. Siegle, 30 Lime Street, London.

MONDAY, JAN. 23, 1899.

## Washington Coal Mines in 1898.

Mr. R H. Norton, writing in *Engineering and Mining Journal* on the topic named in the heading, says:

The year 1898 has been a record breaker, from a coal mining standpoint, in the State of Washington. There is only one mine of any importance where the output for 1898 is less than for 1897. The leading coal mine in the State is the mine of the Northern Pacific Coal Company, at Roslyn. The output of this mine for 1898 is over 500,000 tons, 150,000 tons more than in 1897. Notwithstanding this increased output the mine is in splendid condition, great foresight and judgment having been used by the management. New developments and machinery in process of erection will increase the out put for 1899 very considerably. The local mines in this vicinity have also considerably increased their output, and several properties are in process of development. A similar condition exists in Pierce county. All the mines in operation in this county have materially increased their output, and judging from new ground broken and machinery erected, will show a steady increase in future. One very pretentious undertaking and two or three smaller ones have been started during the year now drawn to a close. The banner county for the production of coal in the State of Washington is King county. There are about a dozen coal mines in active operation in this county, four of them with a capacity of 500 to 1,000 tons per day. As in other sections of the State, developments in this county have been quite extensive, so much so, that by the time the season opens in 1899 it will be an easy matter to double the present output.

It is not too much to say that the demand for Washington coal will go on steadily increasing; the rapidly growing Alaska trade has been one of the chief sources of demand, and enough is known of that country now to insure its continuance. Honolulu and our other recent acquisitions are also going to be consumers of Washington coal, as the duty on Canadian coal, which they have used there heretofore, is a factor in favor of our home product. California, as usual, has used large quantities of Washington coal.

In conclusion, there can be no doubt but that the future prospects of this industry in this State are good. There are thousands of acres of coal lands in the State that are awaiting development, and while the mines already in operation are probably adequate to supply the demand for some years, the immense area of known coal lands insures permanency to the industry and profit in its successful and economical operation.

## The Market for Gas Securities.

Dullness and weakness were the characteristics of the market for city gas shares since time of last writing, although to-day (Friday) a better feeling seems prevalent. The war for business is still being waged, and good authority declares that concessions in the shape of rebates from the lawful selling rate are being offered. We sincerely hope this is not so, for from our point of view the practice is simply suicidal. The Legislature is in session, and some of our legislators are not in any sense slow to avail themselves of the capital they could extract just now from a rate war in this city. Consolidated at noon to-day sold at 191. New Amsterdam is 31⅞ to 32¼, and Mutual is 302 to 307. Central Union bonds advanced sharply to 107½ to 108¼.

Brooklyn Union is perceptibly weaker, at 140 to 141. Peoples, of Chicago, more than holds its recent gain, and is now quoted at 112¼ to 112½. Bay State hovers around 7, with but little probability of its reaching 11. Consumers, of Jersey City, is 86 bid, and Baltimore Consolidated shows no change. Buffalo gas is much weaker, and Syracuse is also in the declining list. Western gas is well on its way to par. The recent rise in Louisville gas is maintained. It seems to be settled that Mr. Udolpho Snead will succeed Mr. Morris in the Presidency of the Company. Lacledes are steady, with a particularly good inquiry for the preferred, which is 99 to 100. The general situation seems in favor of the investor, which inference is justified by the knowledge that our output returns show good increases over those for the corresponding period of last year.

## Gas Stocks.

**Quotations by George W. Close, Broker and Dealer in Gas Stocks.**

16 WALL STREET, NEW YORK CITY.

Jan. 23.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

| *N. Y. City Companies.* | *Capital.* | *Par.* | *Bid.* | *Asked.* |
|---|---|---|---|---|
| Consolidated | $37,730,000 | 100 | 190 | 190½ |
| Central Union, Bonds, 5's. | 3,000,000 | 1,000 | 107½ | 108½ |
| Equitable Bonds, 6's | 1,000,000 | 1,000 | 105 | .. |
| " 1st Con. 5's | 2,300,000 | 1,000 | 114 | . |
| Metropolitan Bonds | 658,000 | .. | 108 | 112 |
| Mutual | 3,500,000 | 100 | 302 | 307 |
| " Bonds | 1,500,000 | 1,000 | 100 | 102 |
| Municipal Bonds | 750,000 | .. | .. | .. |
| New Amsterdam Gas Co. | 13,000,000 | 100 | 31¾ | 32¼ |
| Preferred | 10,000,000 | 100 | 66¼ | 67½ |
| Bonds, 5's | 11,000,000 | 1,000 | 103¾ | 104 |
| Northern Union, Bonds, 5's. | 1,250,000 | 1,000 | 94½ | 95½ |
| New York and East River.. | | | | |
| Bonds 1st 5's | 3,500,000 | 1,000 | 111 | 113 |
| " 1st Con. 5's | 1,500,000 | .. | 107½ | 108½ |
| Richmond Co., S. I. | 348,650 | 50 | 70 | .. |
| " Bonds | 100,000 | 1,000 | .. | .. |
| Standard | 5,000,000 | 100 | 126 | 133 |
| Preferred | 5,000,000 | 100 | 149 | 152 |
| Bonds, 1st Mortgage, 5's | 1,500,000 | 1,000 | 112 | 114 |
| Yonkers | 299,65 | 500 | 130 | .. |
| *Out-of-Town Companies.* | | | | |
| Brooklyn Union | 15,000,000 | 100 | 140 | 141 |
| " " Bonds (5's) | 15 000,000 | 1,000 | 118 | . |
| Bay State | 50,000,000 | 50 | 6¾ | 7 |
| " Income Bonds | 2,000.000 | 1,000 | .. | 75 |
| Binghamton Gas Works.. | 450,000 | 100 | .. | .. |
| " 1st Mtg. 5's | 450,000 | 1,000 | .. | . |
| Boston United Gas Co.— | | | | |
| 1s Series S. F. Trust | 7,000,000 | 1,000 | 92 | .. |
| 2d " " " | 3,000.000 | 1,000 | .. | 80 |
| Buffalo City Gas Co. | 5,500,000 | 100 | 14½ | 15½ |
| " " Bonds, 5's | 5,250.000 | 1,000 | 93 | 93½ |
| Central, San Francisco | 2,000,000 | .. | 105 | .. |
| Chicago Gas Co. Guaranteed Gold Bonds | 7.650,000 | 1.000 | 104 | 104¼ |
| Columbus | 1,144,700 | 100 | 70 | 75 |
| 1st Mortgage | 1,207,000 | 1,000 | 101 | 103½ |
| Consumers. Jersey City | 2,000,000 | 100 | 86 | 90 |
| " Bonds | 600,090 | 1,000 | 104 | 106 |
| Cincinnati G. & C. Co. | 8,500,000 | 100 | 202¾ | 203½ |
| Consumers, Toronto | 1,600,000 | 50 | 184½ | 187 |
| Capital, Sacramento | 500,000 | 50 | .. | 35 |
| Bonds (6's) | 150,000 | 1,000 | | |
| Consolidated, Baltimore | 11,000,000 | 100 | 68 | 68¼ |
| Mortgage, 6's | 3,600,000 | .. | 107 | 107½ |
| Chesapeake, 1st 6's. | 1,000,000 | .. | .. | .. |
| Equitable, 1st 6's. | 910,000 | .. | .. | .. |
| Consolidated, 1st 5's | 1,490 000 | | .. | .. |
| Consolidated Gas Co. of N.J. | 1,000,000 | 100 | 15 | 17 |
| " Con. Mtg. 5's | 380,000 | 1,000 | 80 | 82 |
| Consolidated G. & E. Co.'s., Little Falls, N.Y. | 90,000 | 100 | .. | 100 |
| Bonds | 75,000 | .. | .. | 100 |
| Detroit City Gas Co | 4,560,000 | 50 | 65 | 65½ |
| " Prior Lien 5's | 4,546,000 | 1,000 | 94¼ | 94½ |
| Detroit Gas Co., 5's | 423,000 | 1,000 | 95½ | 96 |
| " Inc. 5's | 31,000 | 100 | .. | .. |
| Equitable Gas & Fuel Co., Chicago, Bonds | 2,000,000 | 1,000 | .. | 101 |
| Fort Wayne | 2,000,000 | .. | 68 | 70 |
| " Bonds | 2,000,000 | .. | 80 | 82 |
| Grand Rapids Gas Lt. Co.. | 1,000,000 | 50 | .. | .. |
| " 1st Mtg. 5's | 1,125,000 | 1,000 | .. | . |
| Hartford | 750,000 | 25 | .. | 145 |
| Indianapolis | 2,000,000 | .. | 100 | 105 |
| " Bonds, 6's | 2 650,000 | .. | 105 | 106 |
| Jackson Gas Co | 250,000 | 50 | .. | .. |
| " 1st Mtg. 5's | 250,000 | 1,000 | .. | .. |
| Jersey City | 750,000 | 20 | 210 | .. |
| Lafayette Gas Co., Ind. | 1,000,000 | 100 | 68 | 70 |
| Bonds | 1,000,000 | 1,000 | 81 | 86 |
| Louisville | 2,570,000 | 50 | 106 | 108 |
| Laclede, St. Louis | 7,500,000 | 100 | 52½ | 53 |
| Preferred | 2,500,000 | 100 | 99 | 100 |
| Bonds | 10,000,000 | 1,000 | 107½ | 108 |
| Madison Gas & Elec. Co. | 400,000 | 100 | .. | .. |
| " 1st Mtg. 6's | 350,000 | 1,000 | .. | .. |
| Montreal, Canada | 2,000,000 | 100 | 200 | .. |
| Newark, N. J., Gas Co | 1,000,000 | .. | 200 | 220 |
| Bonds, 6's | 4,000,000 | .. | 128 | 130x |
| New Haven | 1,000,000 | 25 | 252 | .. |
| Nashville Gas Lt. Co | 1,000,000 | 50 | 110 | .. |
| Oakland, Cal. | 2,000,000 | .. | 53½ | 55 |
| " Bonds | 750,000 | .. | .. | .. |
| Peoples G. L. & Coke Co., of Chicago | 25,000,000 | 100 | 112¼ | 112½ |
| Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage | 20,100,000 | 1,000 | 111½ | 112 |
| 2d " | 2,500,000 | 1,000 | 104 | 105 |
| Peoples, Jersey City | 500,000 | 50 | 240 | 250 |
| Rochester Gas & Elec. Co.. | 2,150,000 | 50 | 52 | .. |
| Preferred | 2,150,000 | 50 | 105 | .. |
| Consolidated 5's | 2,000,000 | .. | 87½ | 90 |
| San Francisco, Cal. | 10,000,000 | 100 | 88½ | 89 |
| St. Paul Gas Light Co | 1,500,000 | 100 | 50 | 52 |
| 1st Mortgage 6's | 650,000 | 1,000 | 82 | 85 |
| Extension, 6's | 600,000 | 1,000 | .. | .. |
| General Mortgage, 5's | 2,428,000 | 1,000 | 80 | 82 |
| St. Joseph Gas Co | 1,000,000 | 100 | .. | .. |
| " 1st Mtg. 5's | 750,000 | 1,000 | . | .. |
| Syracuse, N. Y. | 1,750,000 | 100 | 18 | 20 |
| Bonds | 1,612 000 | 1,000 | 85 | 89 |
| Washington, D. C | 2,600,000 | 20 | 200 | .. |
| First mortgage 6's | 600,000 | .. | .. | .. |
| Western, Milwaukee | 4,000,000 | 100 | 95 | 96 |
| Bonds, 5's | 3,830,500 | . | 106 | 108 |
| Wilmington, Del. | 550,000 | | 204 | 206 |

# Advertisers' Index.


**GAS ENGINEERS.**

| | Page |
|---|---|
| Wm. Henry White, New York City | 139 |
| Fred. Bredel, Milwaukee, Wis. | 135 |
| Geo. R. Rowland, New York City | 139 |
| The Western Gas Construction Co., Fort Wayne, Ind. | 108 |
| Humphreys & Glasgow, New York City | 132 |
| American Gas Co., Phila., Pa. | 126 |
| David Leavitt Hough, New York City | 141 |
| Economical Gas Apparatus Construct'n Co.,Toronto,Ont. | 139 |
| Baxter & Lynn, Detroit, Mich. | 124 |
| United Gas Improvement Co., Phila., Pa | 131 |

**PROCESSES.**

| | |
|---|---|
| Bartlett, Hayward & Co., Baltimore, Md. | 137 |
| United Gas Improvement Co., Phila., Pa. | 131 |
| Burdett Loomis, Hartford, Conn. | 138 |
| National Gas and Water Co., Chicago, Ills. | 133 |
| Economical Gas Apparatus Construct'n Co.,Toronto, Ont. | 139 |
| The Western Gas Construction Co., Fort Wayne, Ind. | 108 |
| Humphreys & Glasgow, New York City | 132 |

**GAS WORKS APPARATUS AND CONSTRUCTION.**

| | |
|---|---|
| James R. Floyd's Sons, New York City | 140 |
| Continental Iron Works, Brooklyn, N. Y. | 138 |
| Deily & Fowler, Phila., Pa | 140 |
| Kerr Murray Mfg. Co., Fort Wayne, Ind | 136 |
| Stacey Mfg. Co., Cincinnati, Ohio | 139 |
| Bartlett, Hayward & Co., Baltimore, Md. | 137 |
| Davis and Farnum Mfg. Co., Waltham, Mass. | 136 |
| R. D. Wood & Co., Phila., Pa. | 138 |
| Isbell-Porter Company, New York City | 138 |
| Fred. Bredel, Milwaukee, Wis. | 126 |
| United Gas Improvement Co., Phila., Pa. | 131 |
| National Gas and Water Co., Chicago, Ills. | 133 |
| Economical Gas Apparatus Construct'n Co., Toronto, Ont. | 139 |
| The Western Gas Construction Co., Fort Wayne, Ind. | 108 |
| Humphreys & Glasgow, New York City | 132 |
| Gas Engineering Co., Pittsburgh, Pa. | 136 |
| American Gas Co., Phila., Pa. | 126 |
| Logan Iron Works, Brooklyn, N. Y. | 140 |
| Riter-Conley Mfg. Co., Pittsburgh, Pa. | 132 |
| Baxter & Lynn, Detroit, Mich. | 124 |

**SCRUBBERS AND CONDENSERS.**

| | |
|---|---|
| G. Shepard Page's Sons, New York City | 139 |
| R. D. Wood & Co., Phila., Pa. | 138 |
| James R. Floyd's Sons, New York City | 140 |
| Continental Iron Works, Brooklyn, N. Y. | 138 |
| Gas Engineering Co., Pittsburgh, Pa. | 136 |
| Logan Iron Works, Brooklyn, N. Y. | 140 |
| Riter-Conley Mfg. Co., Pittsburgh, Pa. | 132 |

**TAR AND CARBONIC ACID EXTRACTOR.**

| | |
|---|---|
| G. Shepard Page's Sons, New York City | 139 |
| R. D. Wood & Co., Phila., Pa. | 138 |

**AMMONIA CONCENTRATORS.**

| | |
|---|---|
| Michigan Ammonia Works, Detroit, Mich. | 123 |
| G. Shepard Page's Sons, New York City | 139 |
| Gas Engineering Co., Pittsburgh, Pa. | 136 |

**GAS METERS.**

| | |
|---|---|
| John J. Griffin & Co., Phila., Pa. | 144 |
| American Meter Co., New York and Philadelphia. | 143 |
| Helme & McIlhenny, Phila., Pa. | 143 |
| D. McDonald & Co., Albany, N.Y. | 141 |
| Nathaniel Tufts Meter Co., Boston, Mass. | 142 |
| Maryland Meter and Mfg. Co., Baltimore, Md. | 142 |
| Metric Metal Co., Erie, Pa | 143 |
| Keystone Meter Co., Royersford, Pa. | 142 |
| Detroit Meter Company, Detroit, Mich. | 143 |

**PREPAYMENT METERS.**

| | |
|---|---|
| American Meter Co.. New York and Philadelphia. | 143 |
| John J. Griffin & Co., Phila., Pa. | 144 |
| D. McDonald & Co., Albany, N. Y. | 141 |
| Helme & McIlhenny, Phila., Pa | 143 |
| Nathaniel Tufts Meter Co., Boston, Mass. | 142 |

**GAS AND WATER PIPES.**

| | |
|---|---|
| Ohio Pipe Co., Columbus, Ohio | 141 |
| M. J. Drummond & Co., New York City | 141 |
| R. D. Wood & Co., Phila., Pa. | 138 |
| Warren Foundry and Machine Co., New York City | 141 |
| Donaldson Iron Co., Emaus, Pa. | 141 |
| Utica Pipe Foundry Co., Utica, N. Y. | 141 |

**PIPE CUTTERS.**

| | |
|---|---|
| The Anderson Pipe Cutter Co., East Boston, Mass. | 125 |

**GAS MAIN STOPPERS.**

| | |
|---|---|
| Safety Gas Main Stopper Co., N. Y. City | 124 |

**STEAM BLOWER FOR BURNING BREEZE.**

| | |
|---|---|
| H. E. Parson, Brooklyn, N. Y. | 133 |

**GAS COALS.**

| | |
|---|---|
| Penn Gas Coal Co., Phila., Pa. | 135 |
| Perkins & Co., New York City | 134 |
| Despard Gas Coal Co., Baltimore, Md. | 135 |
| Westmoreland Coal Co., Phila., Pa. | 135 |
| Berwind-White Coal Mining Co., New York and Phila. | 134 |

**CANNEL COALS.**

| | |
|---|---|
| Perkins & Co., New York City | 134 |

**GAS ENRICHERS.**

| | |
|---|---|
| Standard Oil Co., New York City | 135 |
| The Sun Oil Co., Pittsburgh, Pa. | 135 |

**COKE CRUSHER.**

| | |
|---|---|
| C. M. Keller, Columbus, Ind. | 135 |

**GAS GAUGES.**

| | |
|---|---|
| The Bristol Co., Waterbury, Conn. | 124 |

**GAS GOVERNORS.**

| | |
|---|---|
| Connelly Iron Sponge and Governor Co., New York City | 133 |
| Isbell-Porter Co., New York City | 138 |
| R. D. Wood & Co., Phila., Pa. | 138 |
| Wm M. Crane Co., New York City | 124 |

**CEMENTS.**

| | |
|---|---|
| C. L. Gerould & Co., Mount Vernon, N.Y. | 128 |

**RETORTS AND FIREBRICKS.**

| | |
|---|---|
| J. H. Gautier & Co., Jersey City, N. J. | 128 |
| B. Kreischer & Sons, New York City | 128 |
| Adam Weber, New York City | 128 |
| Laclede Firebrick Mfg. Co., St. Louis, Mo. | 128 |
| Cyrus Borgner, Phila., Pa. | 128 |
| James Gardner, Jr., Pittsburgh, Pa. | 128 |
| Henry Maurer & Son, New York City | 128 |
| Baltimore Retort and Firebrick Co., Baltimore, Md. | 128 |
| Parker-Russell Mining and Mfg. Co., St. Louis, Mo. | 128 |
| Brooklyn Firebrick Works, Brooklyn, N. Y. | 128 |

**REGENERATIVE FURNACES.**

| | |
|---|---|
| Bartlett, Hayward & Co., Baltimore, Md. | 137 |
| Fred. Bredel, Milwaukee, Wis. | 126 |
| J. H. Gautier & Co., Jersey City, N. J. | 128 |
| Parker-Russell Mining and Mfg. Co., St. Louis, Mo. | 128 |
| Adam Weber New York City | 128 |

**SELF-SEALING MOUTHPIECE DOORS.**

| | |
|---|---|
| Isbell-Porter Co., New York City | 138 |
| Continental Iron Works, Brooklyn, N.Y. | 138 |
| G. Shepard Page's Sons, New York City | 139 |
| Logan Iron Works, Brooklyn, N. Y. | 140 |
| R. D. Wood & Co., Phila., Pa. | 138 |

**INCANDESCENT GAS LAMPS.**

| | |
|---|---|
| Welsbach Commercial Co., Phila., Pa. | 130 |

**MICA GOODS.**

| | |
|---|---|
| The Mica Mfg. Co., New York City | 128 |

**BURNERS.**

| | |
|---|---|
| C. A. Gefrorer, Phila., Pa. | 138 |
| Wm. M. Crane Co., New York City. | 124 |
| D. M. Steward Mfg. Co., Chattanooga, Tenn. | 123 |

**LAVA GAS TIPS.**

| | |
|---|---|
| D. M. Steward Mfg. Co., Chattanooga, Tenn. | 123 |

**STREET LAMPS.**

| | |
|---|---|
| Welsbach Street Lighting Co., New York and Phila. | 132 |

**PURIFYING MATERIALS.**

| | |
|---|---|
| Connelly Iron Sponge and Governor Co., New York City | 133 |
| Greenpoint Chemical Works, Brooklyn, N.Y. | 138 |
| Gas Purification and Chemical Co., Ltd., London. | 133 |
| van Baarda & Co., Dusseldorf-on-the-Rhine | 122 |

**EXHAUSTERS.**

| | |
|---|---|
| The P. H. & F. M. Roots Co., Connersville, Ind. | 127 |
| Isbell-Porter Company, New York City | 138 |
| Connelly Iron Sponge and Governor Co., New York City | 133 |

**VALVES.**

| | |
|---|---|
| Ludlow Valve Manufacturing Co., Troy, N. Y. | 123 |
| Chapman Valve Manufacturing Co., Boston, Mass. | 123 |
| R. D. Wood & Co., Phila., Pa. | 138 |
| Continental Iron Works, Brooklyn, N. Y. | 138 |
| The P. H. & F. M. Roots Co., Connersville, Ind. | 127 |
| Isbell-Porter Co., New York City | 138 |
| The Western Gas Construction Co., Fort Wayne Ind. | 108 |

**ELECTRICAL APPARATUS.**

| | |
|---|---|
| Wm. Henry White, New York City | 139 |

**GAS ENGINES.**

| | |
|---|---|
| Backus Water Motor Co., Newark, N. J. | 87 |

**ENGINES AND BOILERS.**

| | |
|---|---|
| The Hazelton Boiler Company, New York City | 125 |

**PURIFIER SCREENS.**

| | |
|---|---|
| John Cabot, New York City | 124 |

**GAS STOVES.**

| | |
|---|---|
| American Meter Co., New York and Philadelphia | 129 |
| Maryland Meter and Manufacturing Co., Baltimore, Md. | 142 |
| Keystone Meter Co., Royersford, Pa. | 142 |
| Wm. M. Crane Co., New York City. | 124 |

**GASHOLDER TANKS.**

| | |
|---|---|
| J P. Whittier, Brooklyn, N. Y. | 123 |

**GASHOLDERS.**

| | |
|---|---|
| Bartlett, Hayward & Co., Baltimore, Md. | 137 |
| Continental Iron Works, Brooklyn, N. Y. | 138 |
| Deily & Fowler, Philadelphia, Pa. | 140 |
| Davis & Farnum Mfg. Co., Waltham, Mass. | 136 |
| Kerr Murray Mfg. Co., Fort Wayne, Ind. | 136 |
| Stacey Mfg. Co., Cincinnati, Ohio | 139 |
| R. D. Wood & Co., Philadelphia, Pa. | 138 |
| Logan Iron Works, Brooklyn, N. Y. | 140 |
| Riter-Conley Mfg. Co., Pittsburgh, Pa. | 132 |

**BOOKS, ETC.**

| | |
|---|---|
| Newbigging's Handbook | 123 |
| Scientific Books. | 134 |
| Digest of Gas Cases. | 135 |
| Practical Photometry | 128 |
| Gas Flow Computers. | 125 |
| Hughes' "Gas Works" | 133 |
| Gas Engineer's Pocket-Book | 125 |
| Excerpts from Reports of Gas Commissioners. | 124 |
| Poole on Fuels | 127 |



## Position Wanted

**As Superintendent or Manager of Gas Works.**

Eight years with present Company. Good reasons for making change. Address

1233-3 "E. L. M.," care this Journal.

## POSITION WANTED

**As Superintendent or Manager**

By a thoroughly competent young man with 15 years' experience as Superintendent of works and in the remodeling of same. Address

1233-4 "H.," care this Journal.

## Situation Wanted

**As Superintendent of a Gas Works**

By a man 32 years of age, with 10 years' practical experience in the construction and operation of gas works, water works and electric light plants. Can take charge and manage the affairs of either of the above-named, or all combined. Best of references. Address

1233-2 "R.," care this Journal.

## Position Wanted.

Thoroughly competent man wishes position as Superintendent or Manager of a gas or gas and electric plant.

Address "S. E. R.,"

1220-tf care this Journal.

## FOR SALE.

**A Second-Hand Set of Four Purifying Boxes,** including dry Center-Seal—12-inch Connections, and **Two Hoisting Carriages.** Boxes are 12 feet by 18 feet by 3 feet 6 inches deep; are in good condition, and only sold because have been replaced by larger Boxes and will be sold at a low price.

For terms, etc., address

PORTLAND GAS LIGHT CO.,

1228-tf Portland, Me.

## For Sale.

**A Small Gas and Electric Light Plant,**

in a Southern city of 3,800 inhabitants.

Address FORT WAYNE ELECTRIC CORPORATION,

1097-tf Fort Wayne, Ind.

# Cyanogen.

**A PURIFYING MATERIAL FOR GAS.**

Soft and porous, it can be used in the natural state without any preparation, and it ensures perfect purification.

SPECIMENS AND PRICES ON APPLICATION.

## VAN BAARDA & CO.,

MINE OWNERS,

**DUSSELDORF-ON-THE-RHINE.**

**Utilize Your Gas Liquor.**
NO EXTRA LABOR OR OPERATING EXPENSES.

**Ammonia Concentrator,**

Not Expensive. Write to
STROH & OSIUS, Pat'ees, or
Mich. Ammonia Works, Detroit, Mich.

GASHOLDER TANKS AND
GAS WORKS MASONRY COMPLETE
Plans prepared and Estimates furnished at short notice.
**J. P. WHITTIER,**
70 Rush St., Near Division Ave., Brooklyn, N. Y.

WE ARE THE ONLY
AMERICAN
MANUFACTURERS OF
LAVA . GAS . TIPS
AND
SPECIAL . BURNERS.
Our goods are superior and our prices are right. We earnestly solicit your business in our lines.
The D. M. Steward Mfg. Co.,
CHATTANOOGA, Tenn. AND 107 CHAMBERS ST., New York City.

CHAPMAN VALVE MANUFACTURING CO.
MANUFACTURERS OF
Valves and Gates for Gas, Ammonia, Water, Etc.
Also, Gate Fire Hydrants with and without Independent Nozzle Valve. All Work Guaranteed.
Works & Gen'l Office, Indian Orchard, Mass. Treasurer's Office, 72 Kilby & 112 Milk Sts., Boston, Mass.
Chicago Office, 24 West Lake St. New York Office, 28 Platt St.
St. Louis Office, L. M. Rumsey Mfg. Co., 810 North Second St.

THE
Ludlow Valve Mfg. Co.,
TROY, N. Y., U. S. A.
Double and Single Gate Valves, ¾" to 72",
—FOR—
Gas, Water,
Steam, Oil,
Ammonia, Etc.
HOT GAS VALVES A SPECIALTY.
Send for Catalogue.

Our Mica Chimneys

2 PIECE MICA CHIMNEY.
Etched Chimneys to Order.

For Welsbach Lights
ARE THE
BEST IN THE WORLD.
Get Catalog and Discounts.
The MICA MFG. CO.
Micasmiths,
88 Fulton Street,
N. Y. City.

NOW READY.

THE SIXTH (AND CENTENARY) EDITION
— OF THE —

# Handbook for Gas Engineers and Managers.

By THOMAS NEWBIGGING, M. Inst. C.E.

This Edition of the "Handbook for Gas Engineers and Managers" is a great improvement on all previous editions. Much of the text has been re-written, in order to keep the work abreast of the constant advances that are being made in the Gas Industry.

**PRICE, - - $6.00.**

A. M. CALLENDER & CO., - - No. 32 Pine Street, N. Y. City.

PRACTICAL HANDBOOK ON

# GAS ENGINES

With Instructions for Care and Working of the Same.

**By G. LIECKFELD, C.E.**

Translated with Permission of the author by GEO. M. RICHMOND, M.E.

**Price, $1.00.**

**A. M. CALLENDER & CO., 32 Pine Street, New York.**

# WILLIAM M. CRANE COMPANY,

**Office and Showrooms: 1131 and 1133 BROADWAY.**

Gas Appliances for every purpose, and all up to date.

GAS HEATING STOVES,
GAS FIRES,
GAS RADIATORS,
GAS LOGS,
GAS CANDY STOVES,
GAS GRIDDLES,
GAS FURNACES,
GAS IRONS,
GAS SIGNS,
GAS WATER HEATERS,
GAS KILNS,
GAS LAUNDRY STOVES,
GAS OVENS,
GAS PLATE WARMERS,
GAS OYSTER STEWERS,
GAS CONTROLLERS,
GAS BROILERS,

GAS RANGES,
GAS SOLDERING STOVES,
GAS STEAM TABLES,
GAS CREMATORIES,
BRAY BURNERS,
GAS BURNERS,
GAS TIPS,
GAS SELF-LIGHTING BURNERS,
BY-PASSES,
GAS FITTINGS,
METER COCKS,
SERVICE COCKS,
WAX TAPERS,
GOOSE NECKS,
SOCKETS, ETC.
TUBING,
IRON CASTINGS.

**FOUNDRY:** Peekskill, N. Y.
**OFFICE:** 1131-1133 Broadway, New York.
**FACTORY:** 447 to 453 W. 14th St.

GOODMAN
## GAS MAIN STOPPER
For Shutting Off Gas in Mains Temporarily during Alterations or Repairs.
For Particulars Address
**SAFETY GAS MAIN STOPPER COMPANY,**
211 East 116th Street, New York.

## The Gas Engineer's Laboratory Handbook.
By JOHN HORNBY, F.I.C.
Price, $2.50.
A. M. CALLENDER & CO., 32 Pine Street, N.Y. City

## BAXTER & LYNN.
GAS ENGINEERING
AND
CONSTRUCTION.
Examination Made of Gas Properties.
Values Ascertained, and Advice as to Management.
OFFICE: WAYNE COUNTY BANK BUILDING,
DETROIT, MICH.

Special Trays for Iron Sponge or Oxide of Iron,
**CHURCH'S TRAYS a Specialty.**
Reversible, Strongest, Most Durable, Most Easily Repaired.

553-557 West Thirty-third Street, New York.
We also make the Cheapest and Strongest REVERSIBLE BOLTED TRAYS IN THE MARKET.
*Send for Circulars.*

Bristol's Recording
**PRESSURE GAUGE.**
For continuous records of **Street Gas Pressure.**
Simple in construction, accurate in operation, and low in price.
Fully Guaranteed. Send for Circulars.
**THE BRISTOL CO.,**
Waterbury, Conn.

## EXCERPTS FROM DECISIONS
—OF THE—
## BOARD OF GAS COMMISSIONERS of the COMMONWEALTH OF MASSACHUSETTS.

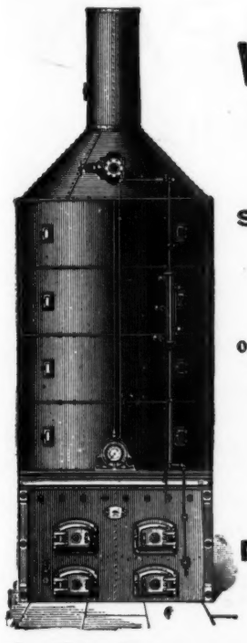
MR. E. H. YORKE, NEW HAVEN, CONN., Dec. 1, 1898.

Dear Sir:—I am in receipt of a copy of "Excerpts from the Decisions of the Board of Gas Commissioners," which is a handy compilation in book form of extracts from the most recent decisions of the Gas Commission of Massachusetts.

I note that most of these extracts are broad and safe-guiding precepts, which apply with equal force to one Company as to another. The 13 years' existence of the Board of Gas Commissioners with its unusual opportunities for acquiring information, have justly made it a high and safe authority in all matters pertaining to the management, obligations, and rights of Gas Companies. Your little book will serve as a valuable reference library in settling legal complications which often arise between a Gas Company and its customers.

Yours truly, (Signed) F. C. SHERMAN, Superintendent.

A 28-page Pamphlet containing the cream of this Board's decisions as to the proper management of Gas Companies.
**Compiled by E. H. YORKE. Price $1.00. Address**
**A. M. CALLENDER & CO., - No. 32 Pine Street, N. Y. City.**



HIGH-PRESSURE
**WATER-TUBE BOILERS.**

**THE HAZELTON OR PORCUPINE BOILER**
IN 50 to 500 H. P. UNITS.

SINGLE BOILERS OR COMPACT BATTERIES.
GREAT SAVING OF FLOOR SPACE
AND FUEL.

LARGE-SIZE BOILERS IN STOCK.

Our new book, "The Generation of Power," will be mailed on request.

**THE HAZELTON BOILER CO.**
Sole Proprietors and Manufacturers.
ALSO BUILDERS OF
Stacks, Tanks and Miscellaneous Metal Work.
GENERAL OFFICE:
No. 716 E. 13th ST., New York, U.S.A.

Cable Address, "Paila," New York.
Telephone Call, 1229-18th Street, New York.

**POOLE ON FUELS.**
THE CALORIFIC POWER OF FUELS.
By HERMAN POOLE, F.C.S.
Price, $3. For Sale by
A. M. CALLENDER & CO., 32 PINE ST., N.Y. CITY.

**The Gas Engineer's Laboratory Handbook.**
By JOHN HORNBY, F.I.C. Price, $2.50.
A. M. CALLENDER & CO., 32 PINE ST., N. Y. CITY.

**BOOKS.**

DISTILLATION OF COAL TAR AND AMMONIACAL LIQUOR.
By GEORGE LUNGE. Price $12.50.

TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS.
By DAVID A. GRAHAM. 8vo., Cloth. Price $3.

Orders for these books may be sent to this office.
A. M. CALLENDER & CO.,
32 PINE ST., N. Y. CITY

THE ANDERSON Patent Cutter Carrying Link
Made in all sizes.
Will cut from 2 in. to 24 in.
Pipe Cutting Tool

For Cutting Cast, Wrought Iron, Gas & Water Pipes.
THE ANDERSON PIPE CUTTER COMPANY, Manufacturers,
163 Liverpool st., E. Boston, Mass
N. Y. Office, 135 Greenwich St
C. H. TUCKER, JR., Manager.
WALDO BROS.,
102 Milk Street, Boston, Mass

**Gas Investments in California.**

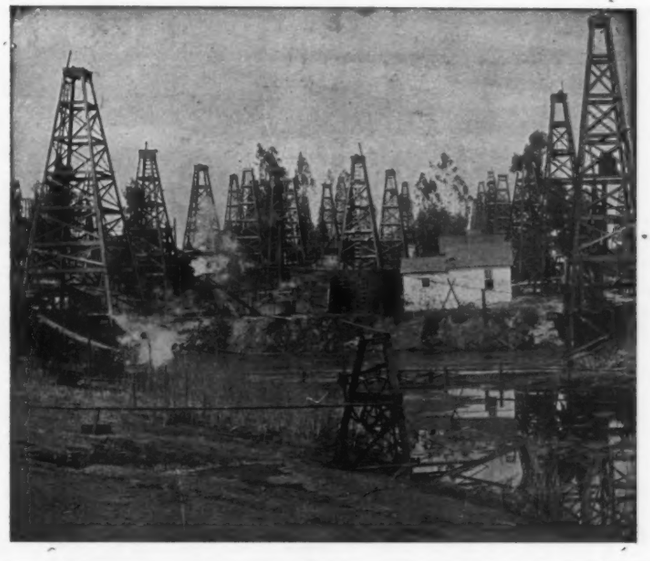
Nowhere else on this continent does such opportunity exist for profitable gas investment as on the Pacific Coast, since the perfection of the new LOWE Process for using the heavy crude California oils (of which there is an unlimited supply) without the use of any other fuels. Seven years' test proves the system to be perfect in every respect. Los Angeles alone, in addition to present street mains, has 150 miles of well built up streets without a gas main on them. To occupy this territory, and a large number of other towns now without gas, we have organized a parent company and a number of local companies covering some of the fastest growing cities in the United States.

Now is the time to invest, when the first capital will be able to double itself in a single year. This is also the most delightful residence section in the United States.

We suggest to those desiring gas investments, in large or moderate amounts—with or without active business connections—to come here and investigate; or, what is the next best thing, write us for particulars and prospectus.

The accompanying cut shows the oil wells in the suburbs of Los Angeles from which the Companies under the NEW LOWE GAS PROCESS obtain their supply of oil.

AMERICAN GAS & COKE CO. (T. S. C. Lowe, Manager),
406 Bradbury Building, Los Angeles, California.



**THE GAS ENGINEER'S POCKET-BOOK.**

By HENRY O'CONNOR.

Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works.

Price, - - $3.50.

A. M. CALLENDER & COMPANY, No. 32 Pine Street, N. Y. City.

# AMERICAN GAS COMPANY

## Constructors of Coal Gas Apparatus.

KLONNE-BREDEL

**Recuperative Furnaces, Washers, Condensers, Purifiers and Purifying Machines, Ammonia Plant, Coke Conveyers, Etc.**

## Complete Works Erected with Guaranteed Results.

EASTERN AGENTS FOR

**FRED. BREDEL'S SYSTEM**
**COAL GAS PLANTS AND GAS APPARATUS.**

**P. H. & F. M. ROOTS CO.'S**
Exhausters, Blowers, etc.

**222 South Third Street, Philadelphia, Pa.**

**GEORGE G. RAMSDELL, General Manager.** **Correspondence Solicited**

# FRED. BREDEL, C.E.

## Coal and Water Gas Plants.

**OWN SYSTEM.**

RECUPERATIVE FURNACES, WASHERS, CONDENSERS, PURIFIERS, PURIFYING MACHINES, COKE CONVEYERS, ETC.

SOLE UNITED STATES AGENT FOR
ARROL-FOULIS MECHANICAL CHARGING AND DRAWING MACHINES.

Gas Enriching Plants to Enrich Coal Gas up to 24 Candle Power, and Making a White, Bright, Non-smoking Gas.

**GAS RETORTS AND SPECIAL BLOCKS AND FIREBRICK MANUFACTURED UNDER THE SUPERINTENDENCE OF MY OWN CHEMIST.**

COMPLETE GAS WORKS

**No. 118 Farwell Avenue, · Milwaukee, Wis.**

**Eastern Agents: AMERICAN GAS CO., Construction Department, 222 So. 3d St., Phila., Pa**

# ROOTS'

## LATEST IMPROVED GAS EXHAUSTER

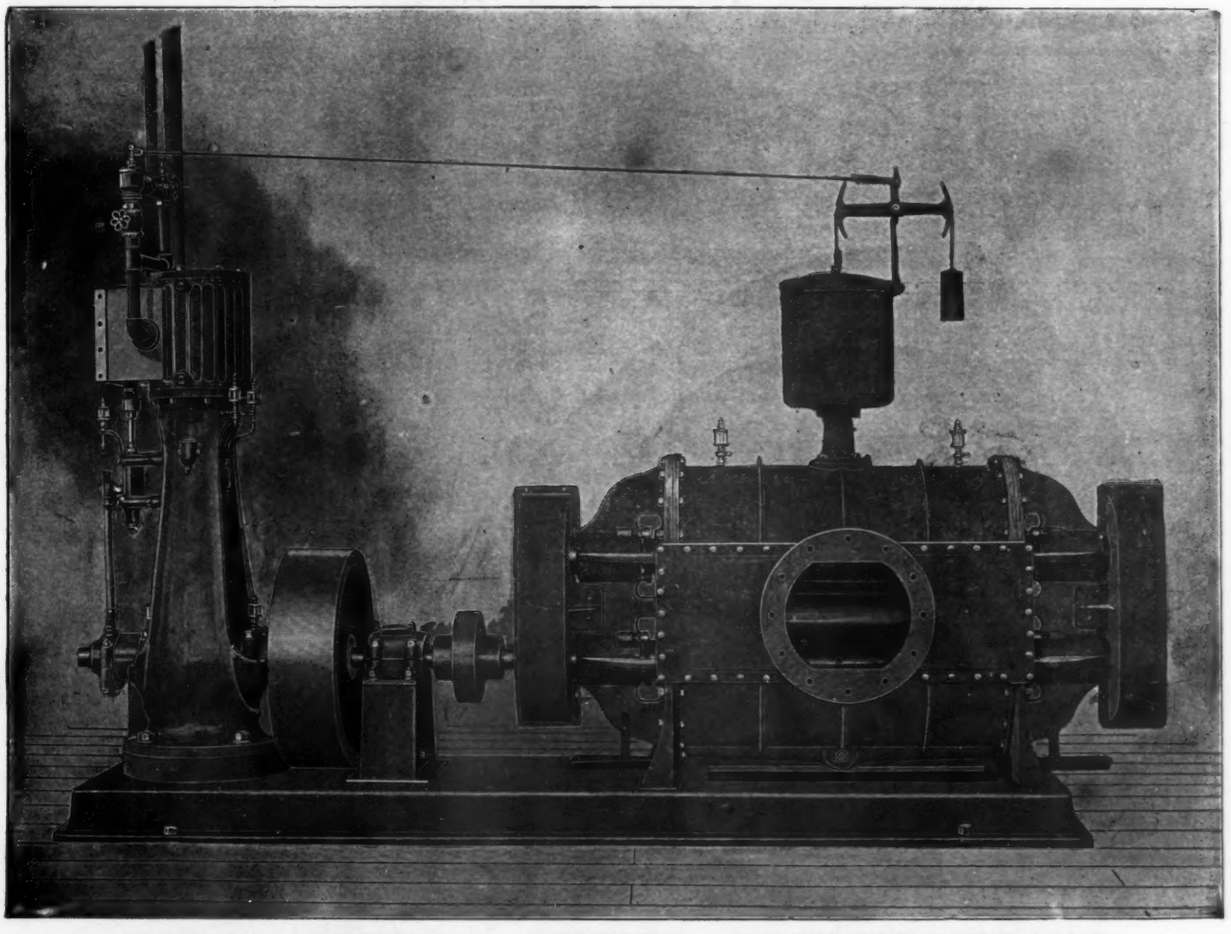
—AND—

## NEW GAS GOVERNOR AND STEAM VALVE.

GUARANTEED TO REGULATE WITHIN ONE-TENTH OF AN INCH, WATER PRESSURE.

## The Most Perfect Gas Governor on the Market.

MORE DIRECT IN ACTION. FEWER PARTS.
EASIER TO ADJUST THAN ANY OTHER GOVERNOR.



INQUIRIES CHEERFULLY ANSWERED. WRITE FOR CATALOGUE.

# P. H. & F. M. ROOTS CO.,

Connersville, Ind. 109 Liberty St., New York.

Eastern Office:

## American Gas Company,

222 South Third Street, Philadelphia, Pa.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY Prest. DAVID R. DALY V. Prest. & Treas.
H. D. ABERNETHY. Sec.

**J. H. Gautier & Co.**

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES,
FIRE BRICK and FIRE CLAY SPECIALTIES

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

E. D. WHITE, President. A. H. GUTKES, Vice-President. H. A. PERKINS, Secretary.

**Brooklyn Fire Brick Works,**

MANUFACTURERS OF

CLAY RETORTS, FIRE BRICK,
Gas House and other Tile.

Office, 88 Van Dyke St. Brooklyn, N. Y.

Established 1854. Incorporated 1869.

**LACLEDE**
**Fire Brick Manufg. Co.,**

Manufacturers of { GAS RETORTS . .
FIRE BRICK . . .
RETORT SETTINGS

Water Gas Cupola Linings, Fire Clay, Etc.

Exclusive Agents for

The Mitchell Half-Depth Regenerative Furnace.

This is the *original* coal-consuming Furnace for Retort Benches. Burns either Coal or Coke. Full and Half-Depth Regenerative Furnaces for Benches of 6's, 7's, 8's or 9's erected complete.

Proprietors of the Coze System of Inclined Retorts.

Office: 901 Pine St., **St. Louis, Mo.**

ESTABLISHED IN 1845.

**B. KREISCHER & SONS,**

Office, 119 E. 23d St., New York.

**Gas Retorts,**

*TILES, FIRE BRICK.*

AND EVERYTHING IN THE FIRE CLAY LINE.

**Adam Weber,**

Proprietor,

Manhattan Fire Brick and Enameled Clay Retort Works.

**Works, Weber, N. J.**

Office, 633 East 15th St., New York.

Modern Recuperative Furnaces

And Standard Fire Brick and Gas Retorts.

Works,
LOCKPORT STATION, PA.

—ESTABLISHED 1864.—

**JAMES GARDNER, JR.,**

Hamilton Building, Fifth Avenue
PITTSBURGH, PA. P. O. Box 373

Successor to WILLIAM GARDNER & SON

**Fire Clay Goods for Gas Works.**

SOLE REPRESENTATIVE OF THE McILHENNY REGENERATIVE BENCHES FOR THE U. S.

**HENRY MAURER & SON,**

(ESTABLISHED 1850.)

EXCELSIOR FIRE BRICK & CLAY

**RETORT WORKS**

WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y.

**Clay Gas Retorts,**

BENCH SETTINGS,

Fire Brick, Tiles, Etc.

**GEROULD'S IMPROVED RETORT CEMENT**

A Cement of great value for patching retorts, putting on mouth-pieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

PRICE LIST.
In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD & CO.,

N. 3d & Prospect Avs., Mt. Vernon, N.Y.

Western Agent, H. T. GEROULD, Centralia, Ills.

**Parker-Russell Mining and Mfg. Co.,**

CITY OFFICE,
417 Pine Street, St. Louis, Mo.

PROPRIETORS OF THE

OAKHILL GAS RETORT & FIRE BRICK W'KS

Our immense establishment is now employed almost entirely in the manufacture of

**Materials for Gas Companies**

We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. We construct

Half and Full Depth Benches of Our Own Design,

Containing 6, 8 or 9 Retorts.

We have Greatly Improved our Recuperators. Coal or Coke can be used as Fuel in Furnaces.

THEO. J. SMITH, Prest. J. A. TAYLOR, Sec'y
A. LAMBLA, Vice-Prest. and Supt.

**BALTIMORE RETORT & FIRE BRICK CO.**

MANUFACTORY AT

LOCUST POINT BALTIMORE MD.

**Clay Retorts, Blocks & Tiles**

FIRE BRICK, FIRE CLAY,
AND FIRE CEMENT.

Red and Buff Ornamental Tiles and Chimney Tops. Baker Oven Tiles 12x12x2 and 10x10x2.

WALDO BROS., 102 MILK ST., BOSTON, MASS.

Sole Agents for New England States.

**PRACTICAL PHOTOMETRY.**

A Guide to the Study of the Measurement of Light.

By WILLIAM JOSEPH DIBDIN.

With Numerous Illustrations. Price, $3.00 A. M. CALLENDER & CO., 32 Pine Street, N. Y. City

(Copyrighted, 1894, by the AMERICAN METER CO.

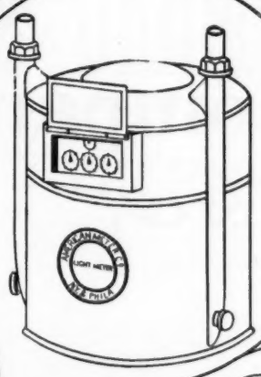
# AMERICAN METER CO.

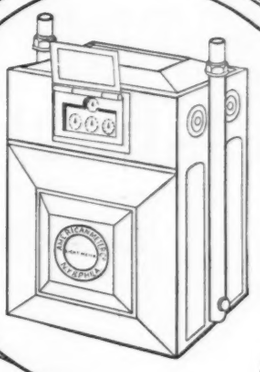
ESTABLISHED 1834. INCORPORATED 1863.

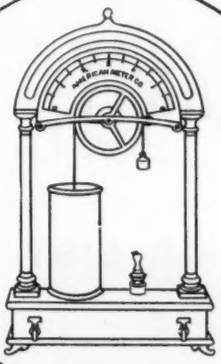
**NEW YORK AND PHILADELPHIA,**

**CHICAGO, ST. LOUIS,**

**SAN FRANCISCO.**



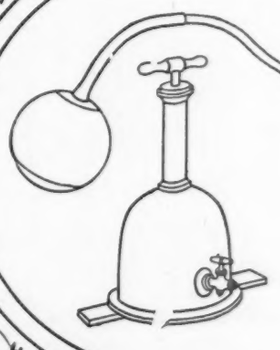


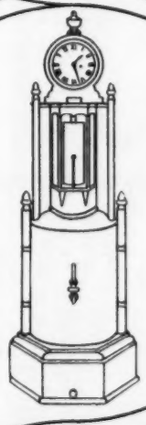


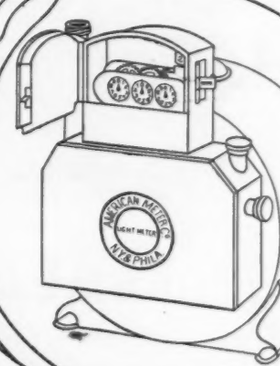
## PUBLIC LIGHTING TABLE.

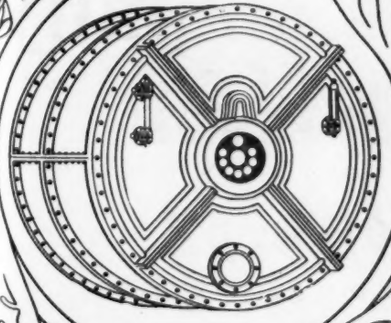
### FEBRUARY, 1899.

| Day of Week. | Table No. 1. Following the Moon. Date. | Light. | Extinguish. | Table No. 2. New York City. All Night Lighting. Light. | Extinguish. |
|---|---|---|---|---|---|
| | | | | P.M. | A.M. |
| Wed. | 1 | 5.50 PM | 12.20 AM | 5.05 | 6.15 |
| Thu. | 2 | 5.50 | 1.30 | 5.05 | 6.15 |
| Fri. | 3 | 5.50 LQ | 2.40 | 5.05 | 6.15 |
| Sat. | 4 | 5.50 | 3.40 | 5.05 | 6.15 |
| Sun. | 5 | 6.00 | 4.50 | 5.10 | 6.10 |
| Mon. | 6 | 6.00 | 6.00 | 5.10 | 6.10 |
| Tue. | 7 | 6.00 | 6.00 | 5.10 | 6.10 |
| Wed. | 8 | 6.00 | 6.00 | 5.10 | 6.10 |
| Thu. | 9 | 6.00 NM | 6.00 | 5.10 | 6.10 |
| Fri. | 10 | 6.00 | 6.00 | 5.10 | 6.10 |
| Sat. | 11 | 6.00 | 6.00 | 5.10 | 6.10 |
| Sun. | 12 | 6.00 | 5.50 | 5.20 | 5.55 |
| Mon. | 13 | 6.00 | 5.50 | 5.20 | 5.55 |
| Tue. | 14 | 10.00 | 5.50 | 5.20 | 5.55 |
| Wed. | 15 | 11.10 | 5.50 | 5.20 | 5.55 |
| Thu. | 16 | 12.10 AM FQ | 5.50 | 5.20 | 5.55 |
| Fri. | 17 | 1.10 | 5.50 | 5.20 | 5.55 |
| Sat. | 18 | 2.00 | 5.50 | 5.20 | 5.55 |
| Sun. | 19 | 2.40 | 5.50 | 5.30 | 5.55 |
| Mon. | 20 | 3.20 | 5.50 | 5.30 | 5.55 |
| Tue. | 21 | 4.00 | 5.50 | 5.30 | 5.55 |
| Wed. | 22 | 4.30 | 5.50 | 5.30 | 5.55 |
| Thu. | 23 | 4.50 | 5.50 | 5.30 | 5.55 |
| Fri. | 24 | No L. | No L. | 5.30 | 5.55 |
| Sat. | 25 | No L. FM | No L. | 5.30 | 5.55 |
| Sun. | 26 | No L. | No L. | 5.30 | 5.45 |
| Mon. | 27 | 6.20 PM | 9.10 PM | 5.30 | 5.45 |
| Tue. | 28 | 6.20 | 10.20 | 5.30 | 5.45 |









## TOTAL HOURS LIGHTING DURING 1899.

| By Table No. 1. | Hrs.Min. | By Table No. 2. | Hrs.Min. |
|---|---|---|---|
| January | 215.40 | January | 423.20 |
| February | 184.40 | February | 355.25 |
| March | 187.40 | March | 355.35 |
| April | 166.50 | April | 298.50 |
| May | 158.00 | May | 264.50 |
| June | 140.50 | June | 234.25 |
| July | 150.30 | July | 243.45 |
| August | 168.30 | August | 280.25 |
| September | 179.50 | September | 321.15 |
| October | 213.20 | October | 374.30 |
| November | 217.00 | November | 401.40 |
| December | 238.10 | December | 433.45 |
| Total, yr. | 2221.00 | Total, yr. | 3987.45 |

# Welsbach Commercial Company,

## DREXEL BUILDING,

## PHILADELPHIA.

**WE NOW SELL**

# THE IMPROVED WELSBACH LIGHT

to all gas companies and first-class dealers in gas appliances.

**SEND FOR NEW CATALOGUE AND PRICE LIST.**

We are now prepared to furnish our New Combination Pilot Jet By-Pass and Adjustable Bunsen.

Our New Hot Wire Electric Igniter is a great improvement in electric gas lighting. Cannot short circuit. Send for prices and full information.

All imitations of the Welsbach light are infringements of the Welsbach patents, and the public is cautioned against purchasing such.

Suits brought by the Welsbach Light Company against manufacturers of infringing lights and mantles are still pending and undetermined.

Every genuine Welsbach lamp has the trade-mark, "Welsbach," conspicuously printed on the package and on the burner itself.


# Welsbach Commercial Company,

## DREXEL BUILDING,

## PHILADELPHIA.

# The United Gas Improvement Company,

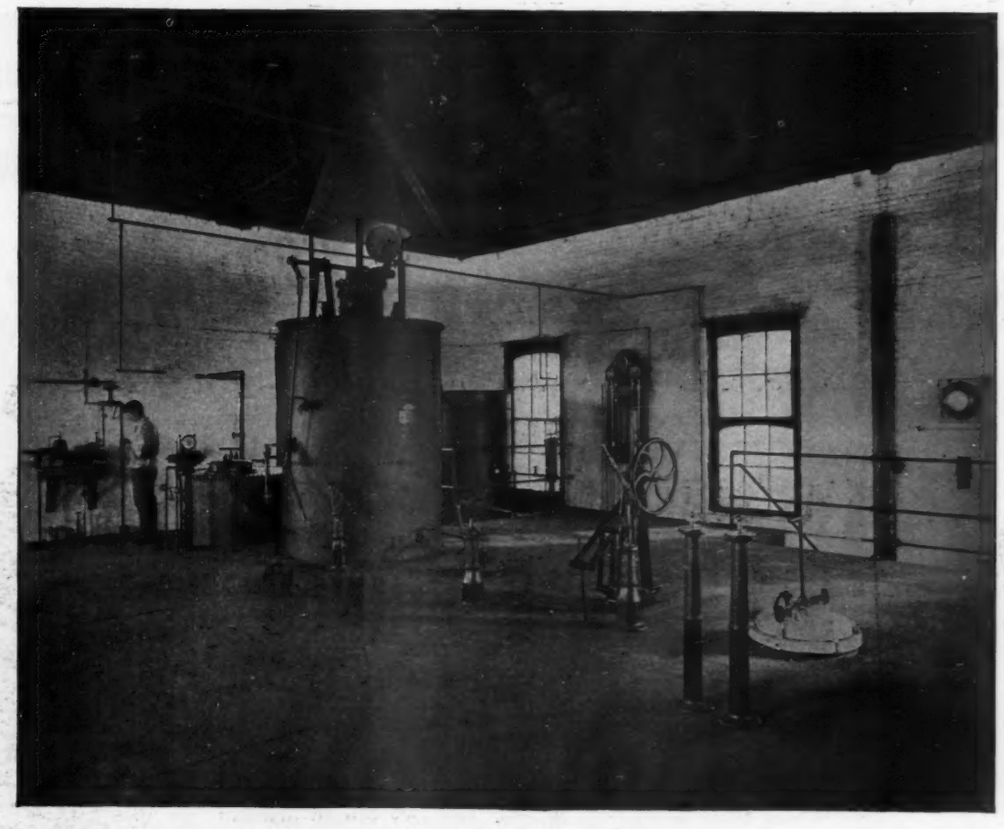
DREXEL BUILDING, PHILA., PA.

---

**The Standard Junior,**

**The Standard Double Superheater,**

## LOWE WATER GAS APPARATUS.



**Total Built and under Construction,**

**294 Sets—Daily Capacity, 187,100,000 Cu. Ft.**

ALEX. C. HUMPHREYS, M. E.,
BANK OF COMMERCE BUILDING,
(31 NASSAU STREET,)
NEW YORK.

CABLE ADDRESS,
LONDON & NEW YORK,
"HUMGLAS."

ARTHUR G. GLASGOW, M.E.,
9 VICTORIA ST.,
LONDON, S. W.,
ENGLAND.

**HUMPHREYS & GLASGOW,**

CONTRACTING AND CONSULTING

**GAS ENGINEERS.**

WATER GAS PLANT A SPECIALTY.
GAS PROPERTIES EXAMINED AND VALUED.
ADVICE AS TO IMPROVEMENT OF GAS PROPERTIES AND MANAGEMENT.

# RITER-CONLEY MFG. CO.,

## GASHOLDERS, with or without Steel Tanks.

Purifiers, Condensers, Scrubbers, Oil Tanks, Smoke Stacks.

**STEEL ROOFS and BUILDINGS.**

PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

GENERAL OFFICE: Pittsburg, Pa. EASTERN OFFICE: 39-41 Cortlandt St., New York City.

NEW YORK, 33 NASSAU ST. PHILADELPHIA, 1932 MARKET ST. CHICAGO, 54 LAKE ST.

# WELSBACH STREET LIGHTING COMPANY

OF AMERICA,

—OWNS, CONTROLS AND OPERATES—
EXCLUSIVELY

## THE NEW IMPROVED AND PATENTED STREET LIGHT BURNER.

STYLE No. 81.

Our PATENTED "STREET LIGHT APPLIANCES" have made WELSBACH STREET LIGHTING a complete success.

By the UNIFORM DISTRIBUTION of light on scientific principles a greater area can be lighted by our system and more economically than in any other way.

Where there are no gas mains already laid, we can furnish an equally good light by our **SELF-GENERATING NAPHTHA WELSBACH BURNER,** enabling Gas Companies to furnish a uniform light in all localities.

Lists of Cities and Towns in which we are now lighting under contract will be furnished upon application.

STYLE No. 97.

**CORRESPONDENCE SOLICITED FROM GAS COMPANIES AND OTHERS INTERESTED IN MUNICIPAL LIGHTING.**

# National Gas and Water Company.

CONTRACTORS FOR
**Gas Plant Machinery**

SOFT COAL OR COKE
WATER GAS GENERATORS
A SPECIALTY.

218 LA SALLE ST.,
CHICAGO.

**Gas Engineers**
INSPECTION AND ADVICE.

PLANS AND ESTIMATES
FOR IMPROVEMENTS OR
REPAIRS.

# CONNELLY IRON SPONGE AND GOVERNOR CO.,

(Successors to CONNELLY & CO.)

MANUFACTURERS OF GAS WORKS SPECIALTIES.

**"IRON SPONGE."** Saves money, saves labor, and is the most efficient purifying material ever offered as a substitute for lime. We guarantee a large saving, both in cost of material and labor.

**AUTOMATIC GOVERNOR.**
OVER FOUR HUNDRED NOW IN USE! NO WORKS COMPLETE WITHOUT IT!
WILL PAY FOR ITSELF WITHIN A YEAR! ITS SERVICE SECURES PERFECT DISTRIBUTION!
REDUCES LEAKAGE TO MINIMUM, and BENEFITS THE COMPANY and CONSUMER ALIKE!
IT IS THE ONLY RECOGNIZED AUTOMATIC GOVERNOR IN THE WORLD!

**STEAM JET EXHAUSTER.** Designed particularly for small works. Combines Exhaust Tube, Steam Governor, Gas Compensator and Bye-Pass Valves in the most compact form possible. Occupies but little space; uses very little steam; saves formation of carbon in retorts; increases yield 10 to 15 per cent. No works too small to use them profitably.

Prices given on all our specialties, delivered at any point in the United States. Correspondence solicited.

**CONNELLY IRON SPONGE AND GOVERNOR CO., No. 357 Canal St., New York.**

## Hughes' "Gas Works,"

Their Construction and Arrangement,

**And the Manufacture and Distribution of Coal Gas.**

Originally written by SAM'L HUGHES, C.E.

Rewritten and Much Enlarged by
WM. RICHARDS, C.E

Eighth Edition, Revised, with Notices of Recent Improvements.

**Price, $1.65.**

A. M. CALLENDER & CO.,
32 Pine St., N. Y. City.

## IRON MASS
For Gas Purification.
Acts immediately, and more efficiently than any other purifying agent now in use.
**GREENPOINT CHEMICAL WORKS,**
Greenpoint Ave. and Newtown Creek, Brooklyn, N. Y.

## The Chemistry of Illuminating Gas.
By NORTON H. HUMPHRYS. Price, $2.40.
A. M. CALLENDER & CO., 32 PINE ST., N. Y. CITY.

## ONEILL'S OXIDE,
(NATURAL BOG ORE)
For Gas Purification.
Has the Largest Annual Sale of Any Oxide in the World.
GAS PURIFICATION AND CHEMICAL CO., LTD.,
160, 161, 162 Palmerston Buildings,
Old Broad St., London, E. C., Eng.

## Parson's Steam Blower,
FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREZEE OR OTHER WASTE MATERIAL.

## PARSON'S TAR BURNER,
FOR USING COAL TAR AS FUEL.

## PARSON'S AIR JET TUBE CLEANER,
FOR CLEANING BOILER TUBES.

These devices are all first-class. They will be sent to any responsible party *for trial*. No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY.

H. E. PARSON, Supt., 67 Bremen Street, Brooklyn, N. Y.

JAMES D. PERKINS, President. F. SEAVERNS, Treasurer.

# THE PERKINS COMPANY,

228 and 229 Produce Exchange, New York City.

TIDEWATER SALES AGENTS FOR THE FOLLOWING:

## Ocean Mine Youghiogheny Gas Coal,
## Old Kentucky Shale and O. K. Boghead.

SHIPMENTS FROM NEW YORK, PHILADELPHIA, BALTIMORE AND NORFOLK.

## BERWIND-WHITE COAL MINING COMPANY'S

## Ocean Westmoreland Gas Coal.

**Offices:**
Washington Building, New York.
Betz Building, Philadelphia.

**STRICTLY** High Grade. . . . . Carefully prepared. For Gas Making or Heavy Steaming.

# SCIENTIFIC BOOKS.

NEWBIGGING'S HANDBOOK. By Thos. Newbigging. 6th edition. $6.

COX'S GAS FLOW COMPUTER. $2.50.

HUGHES' GAS WORKS. $1.65.

POOLE ON FUELS. By Herman Poole. $3.

GAS ENGINEER'S POCKET-BOOK. By Henry O'Connor. $3.50.

TECHNICAL GAS ANALYSIS. $3.

GAS CONSUMER'S HANDYBOOK, by Wm. Richards. 20 cents.

CHEMISTRY OF ILLUMINATING GAS. By Norton H. Humphrys. $2.40.

PRACTICAL TREATISE ON HEAT By Thomas Box. 2d edition. $5.

PRACTICAL PHOTOMETRY: A Guide to the Study of the Measurement of Light. By W. J. Dibdin. $3.

CHEMICAL TECHNOLOGY: Vol. I., *Fuel and Its Applications*, $3. Vol. II., *Lighting*, $4.

IRONWORK: Practical Designing of Structural Ironwork. By H. Adams. $3.50.

GAS WORKS: Their Arrangement, Construction, Plant and Machinery. $5.

PRACTICAL HANDBOOK ON GAS ENGINES, by G. Lieckfield. $1.

LIQUID FUEL FOR MECHANICAL AND INDUSTRIAL PURPOSES. By E. A. Brayley Hodgetts. $2.50.

COAL: Its History and Use. By Prof. Thorpe. $3.50.

THE GAS WORKS OF LONDON. By Colburn. 60 cents.

HEAT A MODE OF MOTION. By John Tyndall. $2.50.

THEORY OF HEAT. By J. Clerk-Maxwell. $1.50.

MANUAL FOR GAS ENGINEERING STUDENTS. By D. Lee. 40 cents.

GASFITTER'S GUIDE, by John Eldridge 40 cents.

AMMONIA AND AMMONIUM COMPOUNDS. By Dr. R. Arnold. $2

CONSTRUCTION OF GAS WORKS, by Walter Ralph Herring. $2.

DIGEST OF GAS CASES. $5.

PRACTICAL HINTS ON REGENERATOR FURNACES By M. Graham. $1.25.

DISTILLATION OF COAL TAR AND AMMONIACAL LIQUOR. By Geo. Lunge. New edition. $12.50.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS. By D. A. Graham. $3.

A TEXT BOOK OF INORGANIC CHEMISTRY. By Prof. Victor Von Richter. $2.

ILLUMINATING AND HEATING GAS. By W. Burns. $1.50

HANDBOOK FOR MECHANICAL ENGINEERS. By H. Adams. $2.50.

TREATISE ON MASONRY CONSTRUCTION. Baker. $5

GAS ENGINEER'S LABORATORY HANDBOOK. By Jno. Hornby. $2.50.

GAS LIGHTING AND GAS FITTING. By W. P. Gerhard. 50 cents.

PRACTICAL PLUMBING. By P. J. Davies. $3.

AMERICAN PLUMBING. By Alfred Revill. $2.

CEMENT: A Manual of Lime and Cement, their Treatment and Use in Construction. By A. H. Heath. $2.50.

### ELECTRICITY.

INDUSTRIAL PHOTOMETRY, with Special Application to Electric Lighting. By A. Palaz, Sc.D. $4.

ELEMENTS OF ELECTRIC LIGHTING, Including Electric Generation, Measurement, Storage and Distribution. By Philip Atkinson. $1.50.

ELECTRIC TRANSMISSION OF ENERGY. By G. Kapp. $3.50.

ELECTRICIAN'S POCKETBOOK. By Monroe and Jamieson. $2.50.

MAGNETISM AND ELECTRICITY. By J. Overend. 40 cts

DYNAMO BUILDING. By F. W. Walker. 50 cents.

DOMESTIC ELECTRICITY FOR AMATEURS. By E. Hospitalier. $2.50.

PRACTICAL MANAGEMENT OF DYNAMOS AND MOTORS. $1.

PRACTICAL GUIDE TO THE TESTING OF INSULATED WIRES AND CABLES. $1.

ELECTRIC LIGHTING, by Francis B. Crocker. $3.

ELECTRIC LIGHT FITTING. $2.

PRACTICAL ELECTRICITY. $2.50.

ELECTRICITY FOR ENGINEERS. $2.50.

ELECTRICITY, Its Theory, Sources and Applications. By John T. Sprague. $6.

The above will be forwarded upon receipt of price. If sent by mail or express, postage or express charges must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order No books sent C.O.D.

**A. M. CALLENDER & CO., 32 Pine Street, New York,**

## The Despard Gas Coal Co.,

MINERS AND SHIPPERS OF

**DESPARD GAS COAL,**

AND MANUFACTURERS OF

**COKE.**

MINES, - - Clarksburgh, Harrison Co., West Va.
WHARVES, - - - Locust Point Baltimore, Md.
OFFICE, - 640 Equitable Building Baltimore, Md.

ROUSSEL & HICKS, 71 Broadway, N. Y. } AGENTS, { BANGS & HORTON 60 Congress St., Boston.

**KELLER ADJUSTABLE COKE CRUSHER.**

Strong, Simple, Durable. Will Crush any Size Desired.

C. M. KELLER,
Sec. & Supt. Gas Lt. & Coke Co.,
**Columbus, Ind.**
Correspondence Solicited.

## Do You Wish to Know

what size of pipe to use to convey any quantity of gas, any distance, with any loss of pressure and any initial or final pressure? Then use

## Cox's Gas Flow Computer,

as it gives this information accurately at sight, without mental effort. No calculations needed. Saves time, money and mistakes.

Price, 6.5 x 8 inches, in cloth case, $2.50. For sale by

**A. M. Callender & Co., 32 Pine St., N. Y.**

## GREENOUGH'S "DIGEST OF GAS CASES."

**Price, $5.00.**

This is a valuable and important work, a copy of which should be in the possession of every gas company in the country, whether large or small. As a book of reference it will be found invaluable. It is the only work of the kind which has ever been published in this country, and is most complete. Handsomely bound. Orders may be sent to

**A. M. CALLENDER & CO., 32 Pine St., N. Y.**

— THE —

## PENN GAS COAL CO.

OFFER THEIR

**Coal, Carefully Screened and Prepared for Gas Purposes.**

Their property is located in the Youghiogheny Coal Basin, near Irwin and Penn Stations on the Pennsylvania Railroad, and on the Youghiogheny River.

Principal Office:

**Room 720, Reading Terminal Building, Phila., Pa.**

**Points of Shipment:**

Pennsylvania Railroad Piers; Greenwich Wharves, Delaware River: Pier No. 1 (Lower Side), South Amboy, N. J.

EDMUND H. McCULLOUGH, Prest. CHAS. F. GODSHALL, Treas. H. C. ADAMS, Sec.

## THE WESTMORELAND COAL CO.

Chartered 1854.

**Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.**

**POINTS OF SHIPMENT:**

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J.,
WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

**Principal Office, 224 South 3d St., Phila., Pa.**

## THE SUN OIL CO.

Crude Oil, Gas Naphtha,
Refined Petroleum, Gas Oil.

**Toledo, O., and Pittsburgh, Pa.**

## Standard Oil Company,

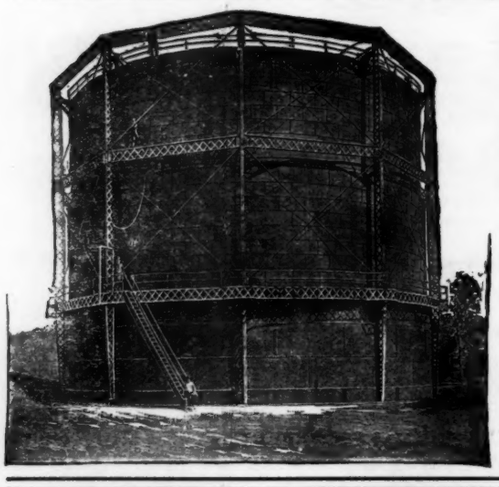
**GAS NAPTHA DEPARTMENT.**

## GAS NAPTHA.

## GAS OIL.

**Correspondence Solicited.**

**26 Broadway, New York City.**



# DAVIS & FARNUM MFG. CO.,

## WALTHAM, MASS.

Principal Office & Works, Waltham, Mass. Boston Office, R'm 18, Vulcan Bldg., 8 Oliver St.

**Single, Double and Triple-Lift Gasholders of any Capacity. Tubular, Pipe and Sinuous Friction Condensers of all Sizes.**

Steel Tanks for Gasholders, Iron Roof Frames and Floors, Purifying Boxes, Center Seal or Valve Connections, Bench Work, Reversible Lime Trays.

**Self-Sealing and Pressed Steel Mouthpiece Lids.**

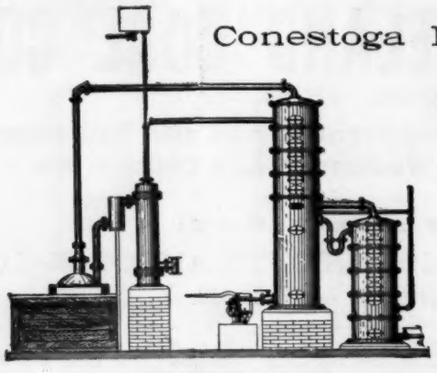
**Coke Borrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Works.**

**Also, Gas and Water Pipe, Flanged Pipe, Sugar House Work, and Special Castings of all Descriptions.**

# GAS ENGINEERING COMPANY.

INCORPORATED,

Conestoga Building, PITTSBURGH, PA.



AMMONIA MACHINE.

MANUFACTURERS OF

**Gas Works Machinery of all kinds,**

PATENTEES AND OWNERS OF

**PITTSBURGH WASHER-SCRUBBER,**

SOLE AGENTS FOR

**FELDMANN AMMONIA MACHINE,**

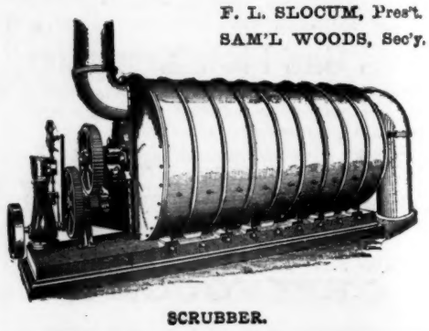
For producing Sulphate, Aqua, Chloride and Concentrated Liquors.

**The Erection of Bi-Product Coke Ovens a Specialty.**

**Faux System of Recuperative Benches.**

**NEW SYSTEM HYDRAULICS.**

F. L. SLOCUM, Pres't.
SAM'L WOODS, Sec'y.



SCRUBBER.

# Kerr Murray Manufacturing Company,

## Steel Gasholder Tanks,

## SINGLE, DOUBLE AND TRIPLE-LIFT GASHOLDERS,

HORIZONTAL AND VERTICAL STORAGE OIL TANKS

**Iron Work for Coal Gas Benches, Self-Sealing Mouthpieces, Exhausters, Condensers, Scrubbers, Purifiers, Wooden Trays, Floor Carriages, Center Seal and Valve System Connections, Cast and Wrought Iron Fittings, and Connections 3 to 36 Inches Diameter.**

**VALVES, Double Gate, Hub and Flange, Outside Screw and Quick Opening, 3 to 36 In. Diam.**

**COAL AND COKE WAGONS, RETORT HOUSE TOOLS, STREET MAIN SPECIALS AND DRIPS.**

**Address,**

# KERR MURRAY MANUFACTURING CO.

**Fort Wayne, Indiana.**

# BARTLETT, HAYWARD & CO.

## BALTIMORE, MD.

## Triple, Double and Single-Lift Gasholders.

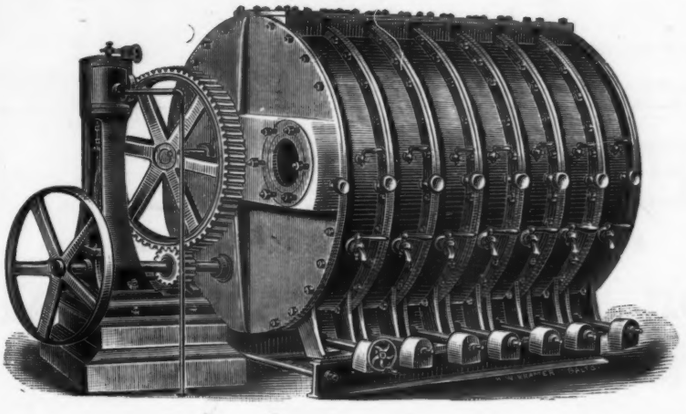
Iron Holder Tanks.

ROOF FRAMES.

Girders.

BEAMS

PURIFIERS.



CONDENSERS.

Scrubbers.

Bench Castings.

OIL STORAGE TANKS

Boilers.

## PATENT STANDARD WASHER-SCRUBBER.

The best apparatus for the extraction of all Ammonia and a large proportion of Carbonic Acid and Sulphureted Hydrogen. The Scrubber has been materially improved and is provided with patented Wooden Segmental Grids, instead of Metallic Discs, thus reducing the weight on shaft and power for operating same.

## The Wilkinson Water Gas Process.

THIRTY-CANDLE, NON-CONDENSIBLE, FIXED GAS. THE MOST SUCCESSFUL GAS PROCESS IN OPERATION.

**MILL'S REVERSIBLE LIME TRAYS.**

Gas Works Designed and Constructed.

# POOLE ON FUELS.

## THE CALORIFIC POWER OF FUELS.

WITH A VERY FULL COLLECTION OF TABLES OF HEATS OF COMBUSTION OF FUELS, SOLID LIQUID AND GASEOUS.

TO WHICH IS ALSO APPENDED

*THE REPORT OF THE COMMITTEE ON BOILER TESTS OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS DECEMBER (1897); TABLES OF CONSTANTS USED.*

By HERMAN POOLE, F.C.S.

FIRST EDITION.

**Price $8. For Sale by**

A. M. CALLENDER & CO. - - No. 32 Pine Street, New York City.

# R. D. WOOD & CO.,

ENGINEERS. IRON FOUNDERS. MACHINISTS.

400 Chestnut Street, Philadelphia, Pa.

MANUFACTURERS OF

## CAST IRON PIPE.

BUILDERS OF

## Gas Holders,

Single, Double and Triple Lifts, with or without Wrought Iron or Steel Tanks.

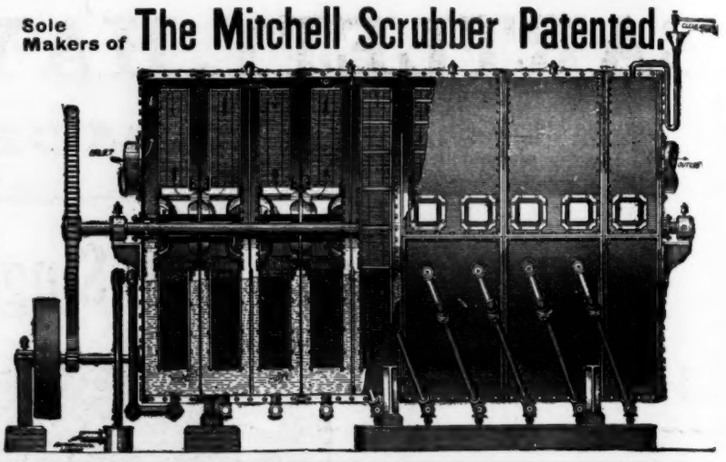
**PURIFIERS, CONDENSERS, SCRUBBERS.**

The Hopper Automatic Gas Governor

**Send for Pamphlet.**

Dunham Patent Specials.

Sole Makers of **The Mitchell Scrubber Patented.**



# ISBELL-PORTER CO.,

**ENGINEERS AND CONTRACTORS FOR THE**

## Construction and Extension of Gas Works.

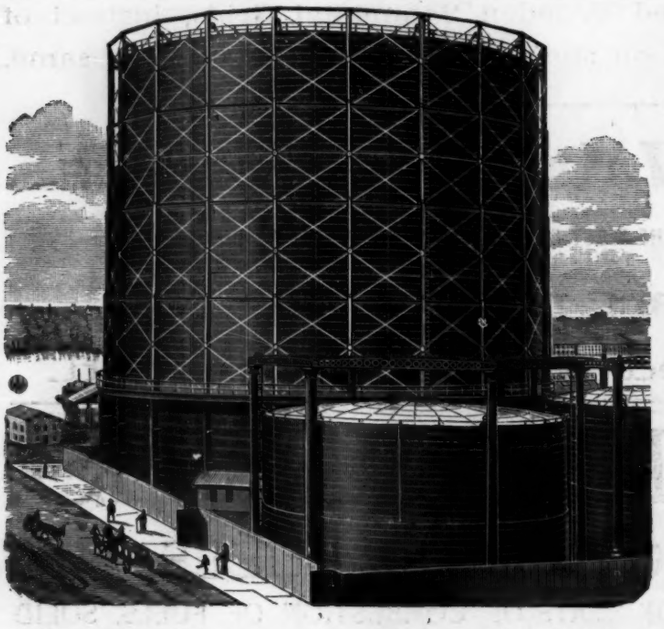
FOUNDERS AND MACHINISTS.

MANUFACTURERS OF

All Ironwork and Machinery Required in a Gas Plant.

Estimates, Drawings and Specifications furnished for the Alteration, Improvement, or Extension of Existing Works or the Construction of New Works.

**245 Broadway, New York City.** OFFICES **Bridge & Ogden Sts., Newark, N. J.**



# The Continental Iron Works,

THOMAS F. ROWLAND, President.
WARREN E. HILL and CHAS. H. CORBETT, Vice-Presidents.
THOMAS F. ROWLAND, Jr., Secretary & Treasurer.

**West and Calyer Sts.** (Near 10th & 23d St. Ferries)
NEW YORK, Borough of Brooklyn.

BUILDERS OF

## Gas Holders.

Single and Multiple Section Gas Holders a Specialty.

STEEL GAS HOLDER TANKS.

**BENCH CASTINGS, RETORT LIDS.**

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, Etc.

## Self-Sealing Retort Mouthpieces & Lids

**For Round, Oval, or "D" Retorts.**

ILLUMINATING GAS! FUEL GAS!

## THE LOOMIS PROCESS.

Now in successful operation at Works of John Russell Cutlery Co., Turner's Falls, Mass., and Henry Disston's Son's Saw Works, Tacony, Pa.

**The Cheapest Gas Generating System in the World.**

Plans and Estimates Furnished.

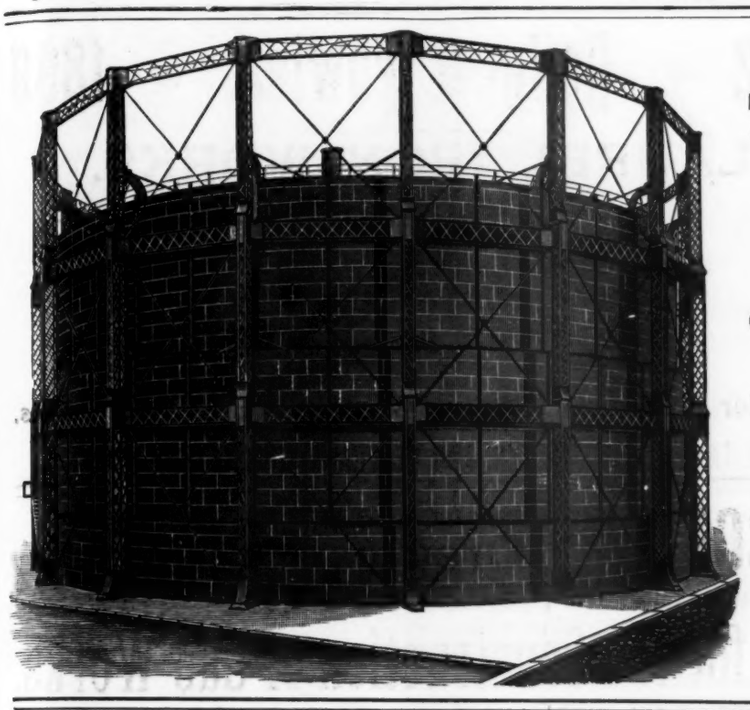
**BURDETT LOOMIS, - - Hartford, Conn.**

**To Gas Companies.**

We make to order **CAP BURNERS** to burn any amount under a stated pressure. Send for samples.

Also, SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

**C. A. GEFRORER,**
**248 N. 8th St., Phila., Pa**



H. RANSHAW, Prest. & Mangr. T. H. BIRCH, Asst. Mangr
WILLIAM STACEY, Vice-Prest. R. J. TARVIN, Sec. & Treas.

**THE STACEY MANUFACTURING CO**

**Established 1851.**

**Single, Double and Triple-Lift**

# GASHOLDERS,

**Of any Capacity, with or without Wrought Iron or Steel Tanks.**

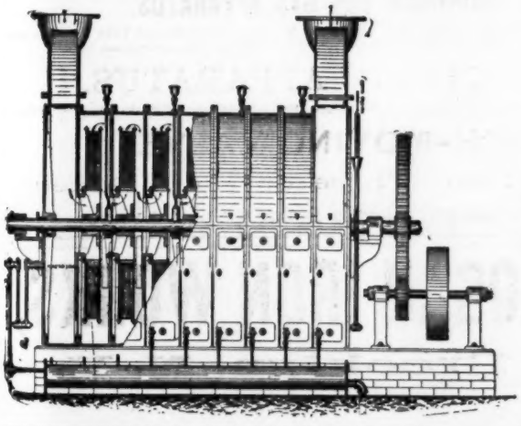
**Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, etc.**

Coal Gas Benches, Roof Frames,

**OIL STORAGE TANKS.**

**Pressed Steel Mouthpiece Lids, Self-Sealing Mouthpiece Lids.**

Cincinnati, Ohio.



## GEORGE SHEPARD PAGE'S SONS,

AGENTS FOR

## The Ammonia Washer-Scrubber

The Ammonia Scrubber (late "Standard") has been before the American Gas Engineers for the past nineteen years. During that time many improvements have been made by the builders, the Isbell-Porter Company, until to-day it stands at the head of all Scrubbers. The fact of there being nearly ninety in use, with a combined capacity of 70,000,000 cubic feet per 24 hours, is of itself sufficient indorsement of its merit. There is no other Scrubber built giving so little back pressure and so much area per thousand cubic feet. Do not be induced to put in a Scrubber until you have acquainted yourself with the AMMONIA SCRUBBER.

Write for Circulars and Blue Prints.

69 Wall Street, = = New York City.

**GEORGE R. ROWLAND.**

**Formerly with the Continental Iron Works.**

**Draughtsman and Constructing Engineer.**

Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.

**Office, No. 245 Broadway, N. Y. City.**

W. H. PEARSON, Prest. J. W. WESTCOTT, Gen'l Mangr. and Treas. L. L. MERRIFIELD, Chief Engr.

**THE ECONOMICAL GAS APPARATUS CONSTRUCTION COMPANY, Limited**

**269 Front Street, East, Toronto, Canada.**

ENGINEERS AND BUILDERS OF THE **IMPROVED LOWE WATER GAS APPARATUS.**

Designed to give the Greatest Efficiency when using any kind of Oil, Anthracite Coal, Gas House or Oven Coke.

New Gas Works Built, Present Gas Plants, either Coal or Water, Remodeled

Catalogues, Plans and Estimates Furnished upon Application.

# WM. HENRY WHITE,

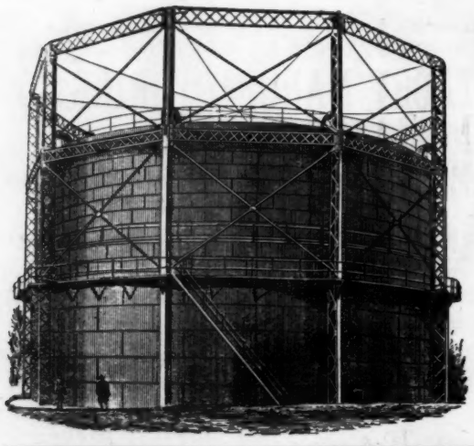
No. 32 Pine Street, - - - New York City.

ENGINEER AND CONTRACTOR FOR THE

ERECTION AND EXTENSION OF

# GAS, WATER, AND ELECTRIC LIGHT WORKS.

Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited
Plans and Estimates Furnished.



# 1842 * Deily & Fowler, * 1899

## LAUREL IRON WORKS.

Office, No. 39 Laurel Street, Philadelphia, Pa

BUILDERS OF

## Gasholders

Single or Telescopic. With or Without Iron or Steel Tanks.

OIL TANKS. WATER TANKS, AND GENERAL WROUGHT IRON WORK.

# JAMES R. FLOYD'S SONS,

Successors to HERRING & FLOYD,

Oregon Iron Works,

West 20th and 21st Streets, Between 10th & 11th Avenues, New York City.

## Engineers and Contractors for the Construction of Gas Works.

MANUFACTURERS OF ALL KINDS OF CASTINGS AND GENERAL IRONWORK FOR GAS APPARATUS.

Bench Castings, Regenerative and Half Regenerative Furnace Castings, Condensers, Tower Scrubbers, Mechanical Scrubbers, Purifiers, Malleable Iron Retort Lids, Self-Sealing Retort Lids, Hydraulic Hoist Purifier Carriage, Crosses, Tees, Bends, Angles, Reducers, S-Bends, Sectional Sleeves, Plugs, Caps, Street Drips, etc., always on hand.

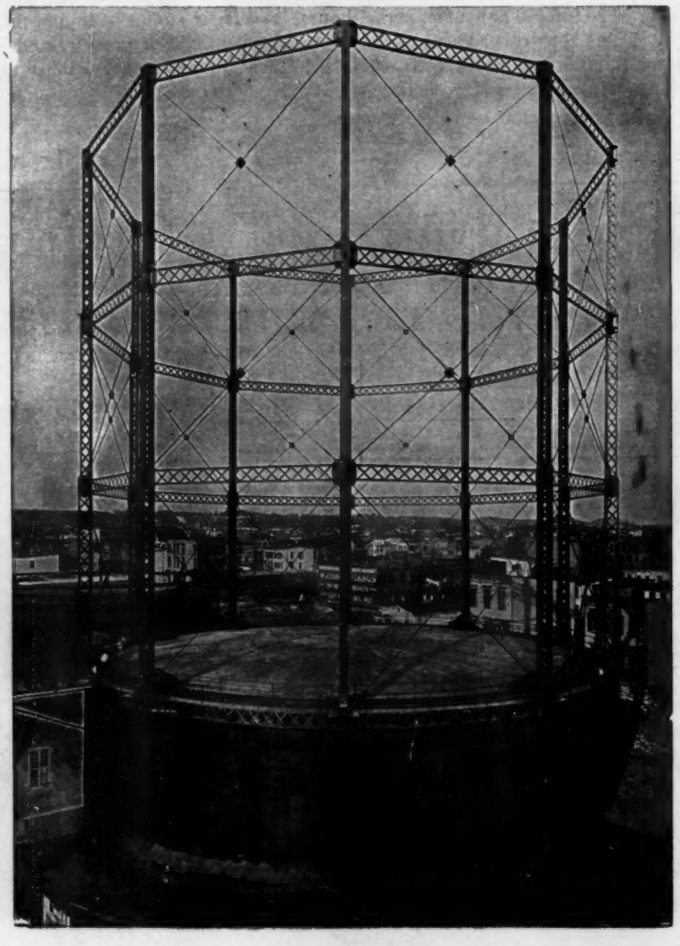
WOOD'S GAS SCRUBBING AND ENRICHING APPARATUS.

In use at Syracuse, Auburn, Watertown, Cortland and Geneva, N.Y.; Elizabeth, N. J.; Boston, Mass.; Jamaica Plain, Mass.; Providence, R. I.; Northern Liberties Gas Co., Phila.

**Sole Manufacturers of the OGDEN QUICK-MOVING VALVE.**

HEARNE CENTER SEAL, Operating One, Two, Three or Four Boxes.

Stroh & Osius Concentrator for Ammoniacal Liquor, used by 50 Gas Companies and Cokeries during the past 4 years.



The order for this Triple-Lift Holder and Steel Tank was received by the Logan Iron Works from the Union Gas Light Company, of East New York. The contract was completed and the Holder was in actual use in 90 days from receipt of order. Capacity of Holder, 500,000 Cu.Ft.

# LOGAN IRON WORKS,

Brooklyn, N. Y.

MANUFACTURERS OF

Single or Multiple-Lift

## GASHOLDERS,

Complete with Steel Tanks.

**BENCHES, SCRUBBERS,**

**CONDENSERS,**

**PURIFIERS, IRON ROOFS,**

**Self-Sealing Retort Lids,**

AND ALL PARTS OF

GAS WORKS APPARATUS.

Contractors for Complete Works.

ALSO, SOLE MANUFACTURERS OF

**C. W. BLODGET'S**

HOT GAS SCRUBBER.

**THE OHIO PIPE COMPANY,**

MANUFACTURERS OF

**Cast Iron Gas & Water Pipe,**

**BRANCH AND SPECIAL CASTINGS.**

Gas-House Bench Castings, Hydraulics, Lamp Posts, Flange Pipe and Specials, Architectural Castings, Building Columns, Joists, Cellar Grates, Sash Weights, etc.

GENERAL FOUNDERS AND MACHINISTS

**Columbus, Ohio.**

**DAVID LEAVITT HOUGH,**

26 CORTLANDT ST., N.Y. CITY.

**Consulting Engineer.**

Investigations and Appraisals.
Designs and Estimates.

**Contractor.**

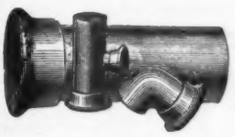
Machinery and Structures.
Gas and Water Pipe.

Special Agent for Selling & Purchasing.

**WARREN FOUNDRY AND MACHINE CO.,**

Established 1856. Works at Phillipsburgh, N. J.

New York Office, 160 Broadway.



**CAST IRON WATER AND GAS PIPE,**

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches. Bends, Retorts, etc., etc

"GLOBE" SPECIALS, VALVES, ETC. "GLAMORGAN" FIRE HYDRANTS

**M. J. DRUMMOND & CO.**

MANUFACTURERS OF

CAST IRON FLANGE GAS AND WATER PIPE

GENERAL SALES OFFICE, 192 BROADWAY, NEW YORK.

Western Office: Monadnock Block, Chicago, Ills.

GEORGE ORMROD, Mangr. & Treas., Emaus, Pa.
JOHN DONALDSON, Prest., Betz Bldg., Phila., Pa

**EMAUS PIPE FOUNDRY.**

DONALDSON IRON COMPANY. EMAUS, PA

MANUFACTURERS OF

**CAST IRON PIPE AND SPECIAL CASTINGS**

FOR WATER AND GAS.

Also, FLANGE PIPE, LAMP POSTS, Etc.

**Practical Hints**

ON THE CONSTRUCTION AND WORKING OF

**Regenerator Furnaces,**

By MAURICE GRAHAM, C.E.

Price $1.25.

A. M. CALLENDER & CO., 32 Pine Street, N.Y.

**CHARLES MILLAR & SON, Selling Agents, Utica, N. Y.**

Flanged Pipe and Fittings, Hydrants, Gates, Pig Lead, Jute, etc.

**UTICA PIPE FOUNDRY CO.**

Manufacturers of Lead Pipe, Solder, etc., and Jobbers of Plumbers' and Tinners' Goods.

**CAST IRON PIPE and SPECIALS FOR WATER AND GAS.**

Wholesale Eastern Agents AKRON VITRIFIED SEWER PIPE.

Established 1854.

# D. McDONALD & CO.,

MANUFACTURERS OF

**WET AND DRY METERS, STATION METERS AND METER PROVERS.**

—ALSO MAKERS OF

# THE GLOVER PREPAYMENT METER.

The amount of gas delivered for the coin can be instantly and positively changed without removing the meter or replacing any parts.

The gas registered agrees absolutely with the amount purchased by the coin.

WE HAVE MADE AND SOLD IN THE UNITED STATES

**OVER 30,000 OF THESE METERS,**

ALL OF WHICH ARE GIVING PERFECT SATISFACTION.

Correspondence Solicited.

511 West Twenty-first Street, NEW YORK. | 51, 53 & 55 Lancaster Street, ALBANY, N. Y. | 34 & 36 West Monroe Street, CHICAGO.

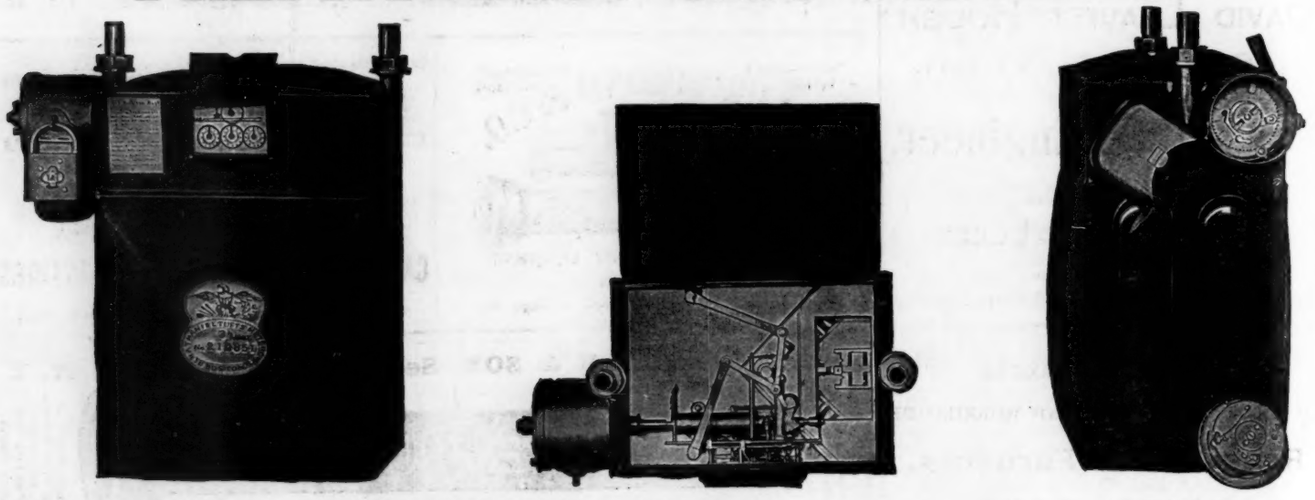
# NATHANIEL TUFTS METER CO.,

Established 1849. 8 MEDFORD ST., BOSTON, MASS.

MANUFACTURERS OF

**Dry Gas Meters, Station Meters, Test and Experimental Meters, Meter Provers, Photometers, Pressure Registers, Pressure Gauges, Etc.**

## PREPAYMENT GAS METERS.



SLIDE SHUT-OFF VALVE ON OUTLET OF METER.

ADJUSTABLE CHANGE PLATE FOR GAS FROM 75c. to $3 per 1,000.

THE EQUAL OF GAS RANGES FOR INCREASING CONSUMERS AND GAS SALES.

CHARLES E. DICKEY. JAMES B. SMALLWOOD. CHARLES H. DICKEY.

# THE MARYLAND METER AND MANUFACTURING CO.

Established 1866.

**BALTIMORE, North & Saratoga Sts.** **CHICAGO, 107 West Monroe St.**
**NEW YORK, 1131 and 1133 Broadway.** **SAN FRANCISCO, 221 Front St.**

**CONSUMERS' & STATION METERS, PRESSURE GAUGES, Etc., Etc.**

## "Perfect" Gas Stoves

THE DIFFERENCE BETWEEN GOOD METERS AND THOSE WHICH ARE "PRETTY GOOD" OFTEN MEANS THOUSANDS OF DOLLARS TO A SINGLE COMPANY.

MANUFACTURE PERFECT GAS METERS

THE KEYSTONE METER CO.

GUARANTEE THEIR WORK TO GIVE SATISFACTION.

Full Line of Sizes Kept Constantly for Sale on the Pacific Coast with
**WIESTER & CO., Agents,**
17 & 19 New Montgomery St., San Francisco, Cal.

OFFICE AND FACTORY, ROYERSFORD, PA.

# American Meter Co.

NEW YORK, PHILADELPHIA,
SAN FRANCISCO.

## Prepayment Meters.

**Their construction is such that they may be readily readjusted when the scale of gas rates is changed.**

# HELME & McILHENNY,

Established 1848. **1339 to 1349 Cherry Street, Philadelphia, Pa.**

MANUFACTURERS OF

## Wet and Dry Gas Meters, Station Meters, Provers, Gauges, Etc.

**METERS REPAIRED**

## PREPAYMENT GAS METERS.

**Our Own Patents. Strong. Simple.** PROMPT ATTENTION. CORRESPONDENCE SOLICITED.

# METRIC METAL COMPANY,

MAKERS OF

## GAS METERS for NATURAL and ARTIFICIAL GAS.

Special Attention given to Repairing METERS of all Makes.

**FACTORY AT ERIE, PA.**

## This is the best time to look after your repairing.

Seventy per cent. of old meters run slow. You are losing money on them. Let us put them in shape for you, a few at a time, until your entire meter equipment is made as good as new. It is better to attend to this matter now, before the Gas Stove season is at its height. Probably we can do such work in our factory better and cheaper than you can do it at home, and just now we can do it promptly.

**The BUHL METERS are as good Meters as you can get.**

## DETROIT METER COMPANY, = = Detroit, Mich.

The advertisement of

THE WESTERN GAS CONSTRUCTION COMPANY, Engineers and Builders,

FORT WAYNE, INDIANA,

WM. HENRY WHITE, Eastern Agent,
32 Pine St., New York.

Occupies this space every alternate week.

# JOHN J. GRIFFIN & CO.,

**1513-1515-1517-1519-1521 Race Street, Philadelphia.**

**52 Dey Street, New York.**
WM. S. GRIBBEL, Manager.

**75 N. Clinton St., Chicago.**
FREDERICK WAUGH, Manager.

MANUFACTURERS OF

## STATION METERS, CONSUMERS' METERS,

Provers, Registers, Gauges, Experimental Apparatus, Etc.

Prompt Attention Given to All Repairing.

## OUR SPECIAL NATURAL GAS METER

**Is the Best ever offered. Over 30,000 now in use.**

We manufacture in the United States, under the **SAWER & PURVES PATENTS**, the

# Positive Prepayment Meter.

. . SIMPLE . .

. DURABLE .

. ACCURATE .

. RELIABLE .

All Parts Interchangeable

This Meter is an unqualified success in Great Britain. Its simplicity of construction, and the positive character of the service performed by it, have given it pre-eminence.

**Needs Only the Care Given an Ordinary Meter.**
**Saves MONEY, TIME and CONSUMERS.**
**Dispenses with "DEPOSITS" and Increases OUTPUT.**